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Electrical and Allied Manufacturing.

THE speech delivered by Sir Benjamin Longbottom on the occasion of the annual gathering of the British Electrical and Allied Manufacturers' Association may be regarded as an official review of the state of the industry and a reasonable statement of the problems with which it has been, and is, confronted.

We devote space to a full summary, because we hold that the whole of our readers in whatever department of electrical activity they are engaged, should have an opportunity of looking at the various questions of the day from the standpoint of the producing section of the industry. We cannot shut ourselves off into watertight compartments as though we were quite independent of everybody else. The success of the whole is dependent upon the well-being of the individual sections and often enough the prosperity of the individual section is contributed to by the pursuance of a broad-minded policy designed to benefit the entire body. Certainly nothing but good can result from all sections of the electrical industry gaining a clear conception of the home and foreign influences that are constantly affecting those directly engaged in the work of electrical production. This they have an opportunity of doing by making a close study of the speech referred to.

Sir Benjamin began by alluding to the progress that had been made recently in strengthening the normal trade relations here, in the British Empire, and in Europe, but while the first effect of the Dawes scheme was to cause a real improvement in the economic situation of Europe, the economic recovery has taken place more markedly in a part of Europe where British electrical industry has less chance of doing advantageous trade because Germany, Austria, and Switzerland already have a firm hold both in an engineering and in a financial sense. In Spain, Italy, France, and Belgium, where we might have looked to obtain an improved volume of trade, there has not been the same recovery.

Germany, strengthened by the Dawes scheme, will also have a greater capacity to control European trade. The speaker alluded in the same connection to the "financial penetration" of America into European industry, some examples of which were detailed in our recent leading article on "International Electrical Relations." He cited the large American loans to well-known German electrical manufacturing and other concerns as instances of the possible dangers to the electrical industry of Britain that might follow the invasion of American capital into Europe, one result of which would be to improve the position of "two of our most formidable competitors abroad."

The pace of our electrical trade with the Dominions is not as it should be, and the speaker called for a close investigation of the subject. He also reviewed the prospects of electrical business in foreign countries where there are signs of general recovery, and considered the adverse effects of financial conditions and rising prices upon production costs. The manufacturers of electrical plant and equipment of all kinds are naturally interested in anything that makes for full national development of power, and it is held that the Government should conduct its investigation of national electric power policy in conjunction with an inquiry into the problem of electrification of transport. Everything which renders the manufacturing interests more efficient by reason of better equipment will help in the inevitable struggle for industrial supremacy. It has been only through superhuman efforts that the electrical industry has been able to maintain a fairly steady volume of foreign trade. The Home industries have been suffering from depression, and the electrical industry has suffered with them in consequence. There was a fairly steady demand on heavy plant manufacturers for power station extensions, but "the demand from industry" was "moribund," and is described as "one of the most disquieting features in the economic position of the industry." Looking at the rate of progress that has taken place in the United States, Germany, and France, Sir Benjamin holds that if we were electrically as well developed as those countries our electrical industry would be employing more than twice the number of men now connected with it. The British manufacturer, however, "with an incompletely developed home market," has "been forced to concentrate on exports, and has sacrificed profits to the desire to maintain a steady manufacturing load." Further: "With a greater volume of foreign trade, he has not yet reached the position where a real return on the capital invested in industry can be earned." Indeed, "it is doubtful," we learn, "whether under conditions similar to those existing at present, the electrical industry will be in a position to show a satisfactory return on capital for several years to come."

The speech ended, however, on a more optimistic note for, notwithstanding everything, 1925 is expected to be productive of an increase in demand for British goods —not spectacular but steady—and a comparatively small increase all round in demand would have "a far-reaching effect on the financial results of our work."

Sir Benjamin admitted that he was frankly optimistic about 1925, and he closed with these words:—

"There should be a real increase in the purchasing capacity of almost every country, and there is no doubt that the high quality and the efficiency of the British product will secure for us a full share of the orders available throughout the world in 1925."

Are we down-hearted, then?

Permanent Magnets.

Whatever criticisms may be levelled at the substance and quality of the discourses ordinarily delivered before the Institution of Electrical Engineers, unquestionably they do not apply to what Mr. Sidney Evershed had to say about permanent magnets, on Thursday last week. Following, as it did, the bestowal of the Faraday Medal upon Sir J. J. Thomson, his address began at an appropriate level, and the Institution was enthusiastic, as it always is when a tale of research work is well told. To Mr. Evershed a magnet is human—a body about which knowledge is beginning to accumulate, a soul concerning which our ignorance is still profound. An experimenter who attains to that degree of intimacy with his subject has solved half his problem, and may approach the remainder with confidence of success. Those who have followed recent advances in the study and manufacture of magnet steels were prepared for some of the remarks concerning temperature, constitution, and what the author described as "potency," that determine the relationship between flux-density and coercive force. Ninety years ago Faraday found that a magnet lost its polarity rather suddenly when the temperature was raised to "scarcely the boiling-point of almond oil." Mr. Evershed expressed the modern constitutional problem aptly when he suggested that there is no "potency" in iron. To impart the requisite retentiveness something must be done to disturb the distribution of the molecules, and it must be done systematically—iron must, therefore, be united with carbon and with some auxiliary element.

The process of hardening by quenching was described as a conjuring trick for securing molecular mobility through the forced retention of carbon. The makers of magnet-steel were held up to the mildest of Evershedian ridicule on account of lack of uniformity in the prescribed carbon content of their products, and altogether this admirable address was a plea for further research, and for more precise operation in magnet-steel manufacture. When it is published it will probably be found that the remarks on "spoiled" steel are of special value. It is a noteworthy contribution to the whole subject of magnet-steel preparation and manipulation, well calculated to inspire research and to improve methods and designs. Moreover, the manner in which the lecture was delivered, without the aid of notes, but with the inspiration flowing from profound study of the subject, might well serve as a model for others to emulate; like the Kelvin lecture of Dr. Jeans, it carried us back in memory to the days when Duddell held his audiences spell-bound. But those who had listened five years ago to Mr. Evershed's previous lecture on permanent magnetism expected no less, and their anticipations were fully realised.

The Shannon Power Scheme.

The publication of the details of the Siemens scheme for the harnessing of the River Shannon, together with the report of the four Continental experts upon it, has directed attention afresh to this ambitious proposition. The additional information now available with regard to the engineering proposals answers some of the objections which have been put forward, and it cannot reasonably be doubted that a large amount of energy can be generated on the lines set forth, whilst substantial benefits would be derived from the improved navigational conditions, and the rescue of agricultural land from periodical flooding, which would accrue from the execution of the scheme.

But the financial aspect of the matter is by no means so clear. Five millions sterling is a large amount for the Free State, with a population of only three millions, to

provide in order to meet a demand for electricity which does not, in fact, exist. The Free State cannot expect to raise a loan for the purpose on very favourable terms, though the experts—who are all foreign engineers, not financiers—surmise that a lower rate of interest may be negotiated than the figure of 5.5 per cent. which they have assumed. Moreover, the cost of civil engineering works, into which many uncertain factors enter, often exceeds the estimates, and the cost of the complete development is expected to be more than seven millions; during the first stage the net revenue would not cover the interest on the capital invested, and only by carrying out the complete scheme is a surplus to be hoped for. Under these conditions the prospect is not very enticing, and if the Free State Government decides not to provide the capital, we doubt whether the German company will exercise its option to carry out the scheme with its own resources.

Another question of the first importance is whether the Irish people, within a reasonable period, can be induced to absorb the output of the works. Hitherto, even in the larger towns, the demand for electricity has been very moderate. In Dublin in 1923 the consumption of energy was 42.3 kWh per head, exclusive of the tramways, which consumed 41 kWh per head—a total of 83.3. Cork showed a consumption of 77 kWh (including tramways), Pembroke 40.3, and Rathmines 31.4 kWh. It may be said that these figures indicate that there is great scope for development; but it must be remembered that Southern Ireland possesses few industries of importance save that of agriculture, and even that is mainly pastoral, so that neither in the towns nor in the country is there a large demand for power. The increased demand, therefore, must be of a domestic nature, and whilst this class of load has enormous potentialities, there is a vast amount of educational work to be done before the Irish people can be brought to realise the advantages of electricity in the home, and before the load factor of the system can be raised to the high value which makes the best use of hydro-electric plant. Many millions of pounds will have to be spent on consuming apparatus, by a nation which is traditionally impecunious, and probably much of this additional capital will have to be provided by the Government or the supply company, in the form of assisted wiring and hire-purchase schemes, to develop the load within a reasonable period. The Dublin papers recognise these important considerations, and have received the scheme and report with a chilly welcome.

It should be pointed out that the price of 0.53d. per kWh which is quoted for the Dublin supply, relates only to bulk supply, and may give a wrong impression to the lay reader; when distribution costs and capital charges are added, including the capital charges which must be paid on the existing generating plant, the average price to the consumer is not likely to be less than 1d.

As has been indicated in our columns, the German scheme has provoked widespread opposition from engineers in the Free State, including the Electricity Supply Association of Ireland; but the Government seems disposed to proceed with it nevertheless.

Sales in Uruguay.

THE principal, and practically the only, purchaser in bulk of electrical material in Uruguay is the Government. The reason for this is that the municipal and similar concerns producing electricity for lighting and power are part of a Government department known as the Usinas Electricas de Montevideo. This organisation is under State control, but has almost a free hand in regulating the operations of the majority of the power works established in the towns of the interior. It seems likely that it will gradually absorb the few private companies which are still in existence by virtue of concessions granted in past years in certain cities fairly distant from the capital. Owing to these reasons individual purchases of electrical material in Uruguay are virtually limited to small apparatus for household or factory use. The bulk of the trade in all cases is done by Germany. The Government stations in making their purchases invite tenders in accordance with specifications, which are generally available two or three months in advance. The quotations should always be for goods delivered to the Custom House at Montevideo. The best way of obtaining business is to dispatch competent travellers and, as the expenses of such a journey may not be warranted by results, it is suggested that a few concerns in non-competitive lines of business should combine for the purpose of sharing the total outlay.

Official Returns.

SECTION 27 of the Act of 1919, which makes it the duty of authorised undertakers to furnish to the Electricity Commissioners such statistics and returns as they may require, has been the cause of a good deal of grumbling on the part of supply undertakers; in private, at least, there has been plenty of expostulatory protest at the trouble of making returns. But such an attitude is a very short-sighted one. The industry, as a whole, stands to gain very much by the comprehensive data which the Commissioners collect and publish. This is especially true in the case of companies. When an industry is prosperous, as is the electricity supply industry at present, there is everything to be gained by ample official statistics being forthcoming. Returns such as are published in the Commissioners' Annual Reports or Returns of Fuel Consumption develop and strengthen the confidence of the investing public, and may have had no small influence in the general success of the capital issues made during the last few years. So companies ought to feel grateful to the Commissioners for the painstaking work they have done in such returns.

Their latest effort was the Return of administrative particulars of electricity supply undertakings, which was reviewed in our issue of January 16th. It would have added to the usefulness of the Return if it had been possible to give, in addition to the specification of area, its extent in square miles; also we do not see a sufficient reason for giving the population only of the authorised distributors and leaving it blank in the case of power companies. There would, of course, have been overlapping, but this could have been made clear by appropriate footnotes. As a work of reference, the Return will be found invaluable.

Railway Station Lighting.

THE second of the informal meetings and visits arranged by the Illuminating Engineering Society—the visit to Waterloo on March 3rd—attracted a very representative gathering, amongst whom many engineers associated with other railway companies were included. This idea of studying conditions on the spot is undoubtedly a happy one. It enables experts to pick up a few "wrinkles," and the subsequent discussion affords an opportunity for the exchange of views between them and the users of light. In this case the users—the general public who utilise the railways—are vitally interested. The Society, in selecting Waterloo for the visit, was doubtless influenced by the fact that this is one of the best-lighted termini; Mr. Cunnington was justly complimented on the skill with which he had utilised the available light.

The complete lighting of a large station, not to mention a railway system, is a costly affair; but it must be admitted that the lighting of many of our termini falls very far behind what is demanded, and compares unfavourably with that of many imposing Continental and American stations. The present time, when the railways are considering expenditure on improvements, is opportune to emphasise the value of proper lighting, and such discussions as those arranged by the Illuminating Engineering Society should have a useful influence in this direction.

Agra Electric Lighting.

Recent Electrical Development in Central India.

After discussions extending over many years, the licence for the electric lighting of the city of Agra was in May last granted to the well-known firm of Martin & Co., of Calcutta, who immediately proceeded to form the Agra Electric Supply Co., Ltd., they themselves acting as the managing agents—a position which they also hold in respect of the United Provinces Electric Supply Co., which operates stations at Lucknow and Allahabad.

Messrs. Handcock & Dykes, of Westminster, consulting engineers to the U.P.E.S. Co., were instructed to prepare the necessary specifications and obtain tenders, it being hoped to have the station running by the hot weather of 1925.

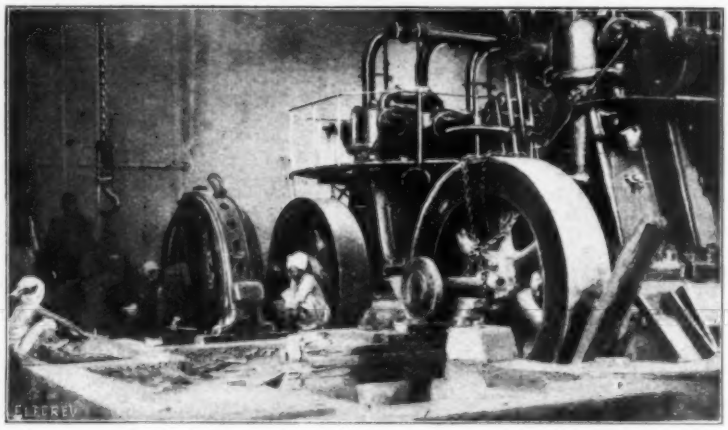


Fig. 1.—Interior of Engine Room during Erection of Exciter.

It will be seen from the photographs of the station taken last month, here reproduced, that excellent progress has been made, and it is expected that a supply of electricity will be available before the end of March, thus constituting what is probably a record in Indian electricity supply.

The generating plant consists of two Ruston and Hornsby vertical cold starting oil engines, each coupled to a 270-kW Crompton alternator, and one similar set of 180-kW capacity. Fig. 1 shows the interior of the engine room before the completion of the installation.

The cooling plant consists of two Heenan & Froude "V"-type coolers, each capable of extracting 2,760,000 B.th.u. per hour. The make-up to the cooling water is supplied through a Boby softener plant, which discharges into a 30,000-gallon underground storage tank, from which the water is circulated to an overhead regulating tank, and thence to the engines, by means of two motor-driven centrifugal pumps. The specified consumption of heavy fuel oil per kW-hour on full load is 0.65 lb., with an allowance of 2½ per cent. when tested new from the works, and the actual figure obtained at the engineers' test was 0.665 lb.

The alternators, built by Messrs. Crompton & Co., Ltd., are 3-phase star-wound, 3,300 volts between phases, with direct-coupled exciters. The switchboard is of the draw-out truck type, and was made by Messrs. Ferguson, Pailin, Ltd.

The supply system is 3-phase, and paper-insulated, lead-covered, double steel tape armoured mains are run underground to four transformer sub-stations, whence the energy is distributed by means of overhead 3-phase, 4-wire mains at 230 volts between phase wire and neutral. The contract for the complete system of underground and overhead mains was carried out by Messrs. Callender's Cable and Construction Co., Ltd.

The generating station is situated within the Cantonment area, just outside the gates of the Fort, and in the picture, fig. 2, the impressive stone walls and magnificent gateway built by the great Mogul Emperor can be seen behind the station building. A view of one of the sub-stations (Agra College) is shown in fig. 3.

The undertaking has been welcomed both by the Europeans in the cantonments and also by the natives in the city, and there can be very little doubt that the company will be as successful at Agra as at Lucknow and Allahabad, where the dividends paid last year were 9 per cent.

Specifications are now being prepared for the stations at Benares and Muttra, and application has been made for a licence for Jubbulpore; thus before very long the majority of the most famous cities in central India will have a supply of electricity available for all purposes.

Mr. H. J. Loughlin has acted as the engineers' clerk of works, and will have charge of the station when completed, under Mr. Bolam—the chief electrical engineer to Messrs. Martin & Co.

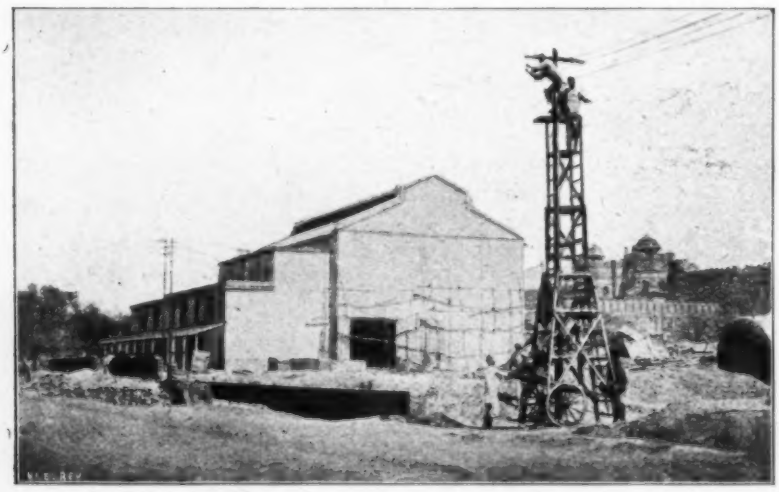


Fig. 2.—Power-station Building and Fort.

Fig. 3.—Agra College Sub-station.

The Work of the B.E.A.M.A. during 1924.

Speech by Sir BENJAMIN LONGBOTTOM.

THE annual meeting of the British Electrical and Allied Manufacturers' Association was held on Thursday, March 19th. At a luncheon held at the Connaught Rooms, Great Queen Street, a full statement regarding the position of the electrical and allied industries and the world influences which are at work was made by the chairman of the Council, Sir Benjamin Longbottom.

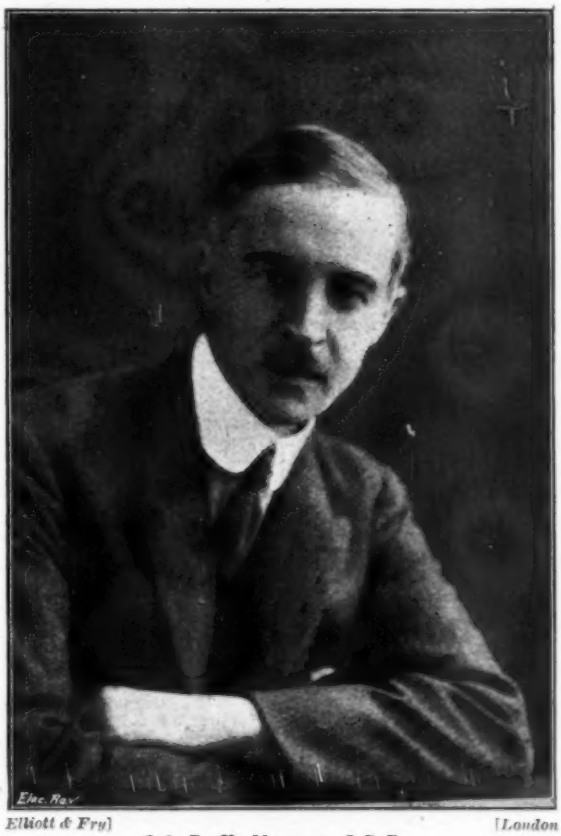
The membership of the Association now numbers 180, as compared with 181 a year ago. Seven new members were elected during 1924 and eight were retired; new members elected during 1923 numbered nine.

The number of meetings held during 1924 was 750 (excluding the sessions of the World Power Conference), as compared with nearly 1,000 during 1923.

At the meeting last week Col. R. K. Morcom, C.B.E. (of Messrs. Belliss & Morcom, Ltd.), was elected chairman of the Council (of which he had been acting as vice-chairman) in succession to Sir Benjamin Longbottom.

Captain R. S. Hilton, in his speech at the luncheon, expressed the high appreciation in which "Sir Bennie," as his friends affectionately call him, is held by all members of the Association. He has put in three strenuous years in the chair.

Col. Reginald Keble Morcom is a member of the Institution of Civil Engineers, of the Institution of Electrical Engineers, of the Institution of Mechanical Engineers, and of the Institute of Naval Architects. In addition to being a director of Messrs. Belliss & Morcom, Ltd., of Birmingham, he is on the board of Lloyd's Bank. He was born in 1877, and married a daughter of the late Sir Joseph Swan.



Elliott & Fry] [*London*

Col. R. K. Morcom, C.B.E.,

The New Chairman of the Council of the British Electrical and Allied Manufacturers' Association.

The Chairman's Speech.

Sir Benjamin Longbottom commenced his speech on the electrical industry in 1924 by stating that the developments of the year proved the accuracy of the surmise ventured by him at the last gathering, which was that industry was on a rising plane of activity. 1924 had contributed to the strengthening of normal trade relations in this country, in the Empire, and in Europe.

The most important development was the Dawes Report. The electrical industry—as one of the great exporting industries—was very closely interested in any scheme which might be instrumental in introducing normal trade relations into the chaos which had ruled in Europe during four years. The Dawes scheme, by abolishing at one stroke the whole system of inflation which threatened to destroy German trade entirely, and by reducing to a real basis of discussion and realisation the Allies' claims for reparations, had made it possible for German credit to find support, not only in Britain, but also in the United States. Contemporaneous, therefore, with the economic recovery of Germany and Central Europe, it had been made possible for German industry to take advantage of those credit facilities which a *régime* of inflation destroyed. The first effects of the Dawes scheme had been to cause a very real improvement in the economic situation of Europe.

There were certain factors, however, which required emphasis if the electrical industry was to benefit from the improved financial and trading conditions which had ensued. The economic recovery of Europe began first in the past year in the Central European States, especially Austria, Poland, Hungary, Jugo-Slavia, and Greece, and had since extended to Germany—a part of Europe where the British electrical industry could scarcely hope to carry out trade advantageously, since Germany, Austria, and Switzerland had already a firm hold on those markets, from the engineering as well as from the financial point of view. On the other hand, the countries in which we could expect to obtain an improved volume of trade, namely, Spain, Italy, France, and Belgium, had not shown the same capacity for recovery, and financial conditions had been distinctly unsettled in them. This was one of the most important features in the international situation and it required careful thought—especially in view of the fact that the Dawes scheme would have as effect the strengthening of Germany and, with Germany, the German capacity to control Central European trade.

America and Europe.

Another feature in the international situation had been the change of spirit in America towards penetration into Europe. America was now carrying out in 1925 that programme of financial penetration which was interrupted in 1919 and which, if carried out in 1919, would have now made America the greatest force in the trade and industry of the world.

The effect of this release of American gold had been very marked in Europe. Since December, 1924, the character of the new capital issues launched in New York had changed entirely; in 1924 such issues were almost entirely Government and municipal; in 1925, however, they had become industrial. Some idea of the significance of this movement could be obtained from the fact that out of a total exportation of gold during 1924 of $61,648,000, December alone was responsible for $39,675,000. Sir Benjamin said he need only give three instances of the possible dangers to the electrical industry of Britain such an invasion of American capital into Europe might bring with it. At the annual meeting of the Union d'Electricité, the largest electricity supply company in France, held on November 24th, 1924, a resolution was passed authorising the company to contract a loan in the United States amounting to $4,000,000 in the form of debentures or bonds maturing over thirty years. This loan would be used to cover the demands of the company for generating plant during the next few years. In addition to this, the German General Electric (A.E.G.) and the Siemens-Schückert Companies entered the New York market for an issue of bonds to the value of $10,000,000 each. The proceeds of this issue would be used to improve their position as two of our most formidable competitors abroad. The movement towards closer alliance with European concerns could be seen from those instances alone.

Trade with the Dominions.

With reference to the importance of the Dominions for the British electrical industry, the Dominions and British possessions absorbed 65.8 per cent. of our total exports of electrical machinery in 1923, a decline of 5.2 per cent. from that of 1922, and in itself a fairly satisfactory indication of a greater spread of exports. Even at this, however, our position in the Dominions was not such as to engender a feeling of optimism. Of a total importation of electrical machinery into India, Australia, South Africa, Canada, and New Zealand during 1923, equivalent to about £4,900,000, imports from Britain totalled £2,780,000, or 57 per cent. of the total, while the United States supplied 34 per cent.

Those figures were very significant. If our trade with the Dominions had come back to pre-war proportions, the British share would have been not less than 70 per cent.,

and this proportion would have represented in 1923 86 per cent. of our total exports. This meant that the value of the Dominions as markets for electrical machinery had been increasing much more rapidly than our exports to them, and the United States was challenging very seriously the position of Britain. Canada, for example, had almost ceased to be a British market, while Australia was absorbing a greater percentage of U.S. manufactures every year. "It is obvious from this that our position in the Dominions requires close investigation."

Foreign Trade.

During the past year exports of electrical machinery rose in weight above the pre-war level, while electrical apparatus, although less satisfactory, had also shown an improvement on the previous year. The past year, although it was not distinguished by any important contracts, was notable for certain orders which were obtained against fierce foreign competition: Brazil, Canada, Spain, India, Russia, Australia, South Africa, New Zealand, and even Italy gave important orders to British firms. South America had been specially interesting owing to the fact that economic conditions improved very greatly during 1924, especially in Brazil and Argentina, and there was no doubt that important developments might be expected in the latter Republic during this year. South American harvests had been good, and India was also improving, as were South Africa and Australia, but two countries weakened the picture of reviving prosperity, namely, China and Japan.

Financial Conditions.

During the past year there was a considerable revival in finance which was generally taken as a fairly sound index of business conditions. There had been a steady upward movement in advances without interruption since the beginning of the year, and the returns for December and January came very close to the record established in 1920. Against this, however, might be set the fact that wholesale prices were also rising and with them the cost of living. This meant that, unless the course of prices moved downwards during the coming year, the British manufacturer, and not least the electrical manufacturer, would be confronted with high rates for financing accommodation and with high production costs. The return of sterling to par was a good thing in itself, but the recent decision to raise the Bank rate to 5 per cent. might be regarded as a source of danger to trade in that it might become a further obstacle to our competitive efficiency abroad. We could not afford to pay heavily for the sentiment of making the sovereign keep at par with the dollar.

We were at the beginning of an upward cycle in prices which, without being spectacular during 1925, might assume considerable importance later. With this upward movement in prices, the cost of production would also move upwards and render more difficult still the position of the British manufacturer. If there were any guarantee that such a movement would be universal and simultaneous, there would be little room for pessimism, but the plain fact remained that prices in Britain now showed perhaps a greater increase over pre-war prices than in any other country.

National Development of Power.

The past year had been distinguished by a revival of interest in the greater national consumption of electricity, in the more scientific utilisation of fuel, and a better co-ordination of existing systems of generation and distribution. Various schemes for improving the present position in electricity supply had been brought forward both by the Liberal and by the Labour parties; the last act of the Labour Government before it went out of office was to advance State support for the scheme of standardisation of frequency. The Government had appointed a special committee to deal with the question of the organising of the national system of power supply, and it might be some time before any real decision emerged. A great proportion of the accusations of inefficient and uneconomic operation which had been levied against existing generating stations might be discounted at once. Power stations were becoming more and more efficient through addition of modern plant, and there were few undertakings in Britain of any importance which could not generate and supply electricity at lower rates than those obtaining even in the United States. The great difficulty in Britain had been lack of main transmission lines linking up isolated areas and lack of a demand sufficient to cover the cost of transmission. The one development which would remedy this lack of national as apart from regional development would be the electrification of the main railway systems. The future lay with electric traction, and the Government Committee, while investigating the question of a national power supply system, should also investigate the problem of electrification of transport.

These developments were of the greatest interest to manufacturers, not merely because they represented an increased demand for electrical machinery, but also because they were an indication of that revived spirit of inquiry into fundamental economic conditions which were essential to the continued progress of Britain.

The home market, so far as the supply side of the industry was concerned, was beginning to expand in a fairly satisfactory fashion. There were five electricity districts finally determined, while draft orders had been prepared for practically every other district provisionally determined. The success of such a division had been illustrated most notably in South-East Lancashire, where there had been a very considerable increase in the generating plant installed or proposed.

The Industrial Demand.

In the struggle for industrial supremacy which must inevitably take place, the nation with the best equipment, manufacturing and financial, must take first place. We might be financially pre-eminent, but the burden of taxation, high transport charges, and the high cost of raw materials in the home market through the operation of those factors, had combined to weaken our competitive position enormously in the markets of the world, and it had only been through superhuman efforts that the electrical industry had been able to maintain a fairly steady volume of foreign trade. The electrical industry had suffered in no small measure from the depression under which other home industries had been suffering. Few industrial concerns had recovered entirely from the trade depression which had ruled continuously during the last four years, with the result that proper provision for depreciation or for obsolescence of plant had been impossible. Thus the electrical industry, which was concerned with the replacement of such plant, had suffered from a very serious reduction in the market available. It was doubtful whether a more favourable time than the present would occur in the near future for the placing of new orders. The greatest proportion of orders carried out during the past year were for extensions to plant in generating stations, to make good the lack of renewals resulting from the war period, and to meet the growing requirements of the supply industry which was, after all, only in the first stages of its development. This, of course, had given rise to a fairly steady demand on heavy plant manufacturers, but the demand from industry had been moribund, and this was one of the most disquieting features in the economic position of the industry.

Research.

The speaker next referred to the importance of research and the policy of continued research that had been adopted in the electrical industry. In this connection he added:—"Our knowledge is increasing rapidly through this work of research into purely manufacturing conditions, but there are deeper problems behind this which go beyond the present scope of research as carried out by the manufacturers. In the effort to obtain greater outputs and higher efficiencies, the materials at present at our disposal may prove insufficient and may lead to serious difficulties. In this search after new materials and new processes, the value of pure science, especially in the development it has followed recently with investigators of the atomic theory, may soon prove its value even for the manufacturer. Many of the phenomena connected with electricity belong wholly to the realm of pure science and, without accurate knowledge of such, our capacity for designing and manufacturing electrical apparatus must be limited. In stating this, I am only repeating what has become almost a commonplace in Germany and the United States. Pure science research is probably on the track of developments which may, in time, change our manufacturing conditions entirely."

A year ago he mentioned that a general decline in unemployment had taken place in general engineering as well as electrical engineering during 1923, but in 1924 this improvement was not fully maintained. Purchasing power was scarcely elastic enough to permit of a greater absorption of their output and, until they got their costs down, the revival of trade would be retarded. The economic condition of the industry was not such as to justify any increase in labour costs without compensating factors, and the steady improvement registered by the electrical industry had only been realised at the cost of reduced profits and, even in some cases, at a loss. The efforts made by the "sheltered trades" to exploit their advantages at the expense of skilled workers in the export industries were a dangerous feature of the present situation and only rendered more difficult still the task confronting the employer and employé alike in maintaining a sound competitive position.

Declining Profits.

When they considered the progress that had been achieved in the United States, Germany, and France, the electrical industry should be employing more than twice the men it employed at the present moment if Britain were electrically as well developed as any of these countries, but the British manufacturer, with an incompletely developed home market, had been forced to concentrate on exports and had sacrificed profits to the desire to maintain a steady manufacturing load. With a greater volume of foreign trade he had not yet reached the position where a real return on the capital invested in industry could be earned. Examination of the balance sheets issued last year would show that 1923, as 1921 and 1922, was characterised by a very serious decline in profits followed by a greater decline still in 1924. It was doubtful whether under conditions similar to those existing at present, the electrical industry would be in a position to show a satisfactory return on capital for several years to come.

After briefly referring to the "Exhibition and World Power Conference" which made 1924 stand out as a red-letter year in the history of the industry, the chairman spoke as follows on the revival of trade and the outlook for 1925: "We are still far from the conditions which existed even

before the war, and until there is an all-round revival of trade, the electrical industry will not be in a sound economic position. What are the essentials in the restoration of favourable trade conditions? It is true that during the last four years the purchasing power of the world taken as a whole has been definitely below that existing in 1913. This can be attributed to the diversion of capital resources in the shape of gold to the United States and to the disappearance of a sound trading and financial policy in practically every country. The free circulation of goods has been rendered impossible through the imposition of high tariffs (the electrical industry has suffered most through this) and through the more disastrous effects of fluctuating currencies which have impeded effectually the free circulation of gold. In other words, prior to the war there was what might be considered an immense floating capital which financed the interchange of goods, and we have not yet returned to the conditions under which the renewal of such a floating capital could be rendered possible. Only the operation of the Dawes plan and the repatriation of the immense gold accumulation of the United States will be able to effect this.

"I am, quite frankly, optimistic about 1925. Although it represents a revived Germany with a burden of taxation less than in Britain, and the United States determined to use their gold accumulation for the financing of trade, 1925 should be productive of an increase in demand for British goods—not a spectacular increase, however, as some of our optimists have been proclaiming, but a steady movement upwards in those fundamental economic conditions which are the backbone of sound trade.

"A comparatively small increase all round in demand will have a far-reaching effect on the financial results of our work. There should be a real increase in the purchasing capacity of almost every country, and there is no doubt that the high quality and the efficiency of the British product will secure for us a full share of the orders available throughout the world in 1925."

Capt. R. S. HILTON, member of the Council, proposed the "Health of the Chairman," and in doing so said that after his three strenuous years of office they could honestly congratulate him on a task well done. Sir Benjamin undertook that task with enthusiasm. His starting torque was enormous; his revolutions had continued constant throughout the three years, and his reliability could only be compared to that of one of his own motors. In three years he had brought added glory to the B.E.A.M.A., and had added to the repute in which the Association was regarded, not only in this country, but abroad and in the Colonies. They remembered with gratitude the enormous load which the chairman took upon his shoulders during the World Power Conference. Capt. Hilton said he would not for a moment detract from the extraordinarily good work done by Mr. Dunlop and his staff in connection with that Conference. He was sure that all who sat round the Council table would regret that the time had come for Sir Benjamin to retire from the chair. Their chairman during his term of office had received from the King the honour of knighthood. They congratulated him upon that, and believed that while he was proud, as he might be, of that knighthood, he really felt prouder of the fact that the knighthood was given to him as chairman of the B.E.A.M.A. While, however, the chairman would be known officially as Sir Benjamin Longbottom, he would always remain to his friends of the Association "Sir Bennie." In that name he asked the company to rise and drink the chairman's health. This was done with acclamation.

SIR BENJAMIN LONGBOTTOM, in responding, said he was deeply sensible of the fact that his three years of office, which terminated that day, embraced the worst period of trade depression that the electrical industry had ever experienced. It had been a severe test for any trade association, but the B.E.A.M.A. had completely vindicated its existence. Notwithstanding their difficulties, they had gone from strength to strength, and he was sure they were all satisfied that, through having learned to co-operate and the advantages of co-operation, the industry was in a far healthier and stronger position than could have been possible if they had remained just a body of individuals as they were in 1911. As an evidence of the B.E.A.M.A.'s co-operation with other bodies, they had at the head table Mr. W. B. Woodhouse, the president of the Institution of Electrical Engineers, and Mr. Ll. B. Atkinson, the director of the Cable Makers' Association. They were also delighted to see present many of their vice-presidents—Lord Vaux of Harrowden, Sir Charles Parsons, Sir Philip Nash, Sir James Kemnal, and Mr. W. Rutherford. He would dearly like to think that when they met again in twelve months' time trade would have recovered to such a degree that they would be inclined to refer to their late chairman as the Jonah of the industry. What was the secret of the B.E.A.M.A. success? He thought Mr. Dunlop would be the first to agree with him that it could be summed up in the word "service"—not just the service of the B.E.A.M.A. staff, but the service of the men who had devoted their time to the work of the many committees with one common aim in view, the betterment and development of their industry. He knew of no greater satisfaction than that of service in whatever sphere it might lie. Until one had occupied the chair of the B.E.A.M.A., it was impossible to form a true estimate of the B.E.A.M.A. staff. From Mr. Dunlop downwards their loyalty, their enthusiasm, and their capacity for work was unlimited, and it had been a real privilege and joy to him to work with them. He would always remember with pride that Mr. Dunlop and he commenced their trade association work on the same day. In March, 1909, they joined the Executive Committee of the National Electrical Manufacturers' Association, the development of which Association led to the formation of the B.E.A.M.A. in the autumn of 1911. They had worked together without a break since then, and he hoped the time was far distant before either of them would discontinue his service to the B.E.A.M.A.

We shall publish a summary of the report of the Council in our next issue.

Electrical Development in New Zealand.

Some Impressions produced by a recent Visit.

By V. FERRANTI.

IT is to be doubted if Great Britain has anything to learn from other countries with regard to the technique of electricity supply and distribution. Very little experience of foreign travel, however, must convince one that our own land is by no means so far advanced as it might be in the application of this form of power to the daily problems of life and work.

Englishmen are apt to take it for granted that circumstances peculiar to foreign countries have much to do with the more general employment of electricity abroad. It is true that in many places there is far less intense competition from gas, either because buildings are scattered, coal is scarce, or development has taken place since the introduction of the electric method. It is also often assumed that in foreign countries, and particularly where water power is available, electricity is extremely cheap as compared with the cost obtaining in our own land; this is not true in the general case—our principal and best-organised electricity areas sell energy from thermal generating stations at rates lower than those usually charged by hydro-electric undertakings.

On the other hand, the methods of distribution and installation in vogue abroad are notably simpler and less expensive than at home, and close attention should be directed to our own methods of distribution; from a commercial point of view, we have perhaps been unduly cautious in that branch of the work, which each day becomes a more dominant feature in the cost of supply and the expenditure that must be incurred by the consumer.

It is of peculiar interest to the Britisher to observe how his own kinsmen in remote parts of the Empire deal with the electrification problem, and in no place is there more to be learned than in New Zealand. This British Dominion, most remote from the Old Country, is one of its greatest suppliers of foodstuffs and also of wool, the raw material of an industry for which these islands were famous before New Zealand was discovered. It has an area of 104,000 square miles and a population less than one-fifth of that of London, so that it presents problems all its own, and the manner in which its people are employing natural sources of power, and adapting age-old waterfalls to methods of electrification which leave many of our own cities far behind, is of particular interest at the present time.

In all directions already one finds transmission or distribution lines, speaking eloquently of the work which electric power is doing in the development of the

Dominion, and showing to the traveller that here electricity is a domestic and social force, influencing the home life and the productivity of the land as much as it affects the productivity of the dense industrial areas at home.

The reason for this rapid development appears to be rather psychological than scientific. To use an American expression, the people of New Zealand are "sold" on the electrical idea; they talk of "hydro," referring with a proprietary sort of familiarity to the Power Boards and their work. These Boards, consisting of small bodies of men who appear to have the confidence of the people, are subject to little restriction and can back their powerful propaganda on behalf of electricity by ability to make those who are slow to adopt it bear any financial burden that their reluctance may cause.

It is not impossible that the spectacular character of the great waterfalls has something to do with the popularity of "hydro" electricity. The people see these sources of power running to waste, and are continually reminded that they could be employed to lighten labour and to add to their comfort. So the electrification idea has become a popular or national one, the legislation necessary is passed with ease, and the country has been divided amongst Power Boards which distribute the energy generated by the State.

These Boards are elected by the people in the various areas, and have no other duty to perform, being in this respect unlike our own municipalities, which control electricity supply amongst many other important activities.

When an electrical distribution area is constituted, a Power Board is elected and the area is carefully canvassed preparatory to a poll of the people, which is required for agreement to the levying of a rate on the district, on the security of which capital can be raised.

So far the polls have been overwhelmingly in favour of this procedure, and the efficient and quite human propaganda appeals made by the Boards are strongly supported by their power to allow users of electricity to set off the value of their accounts against any rate which may be imposed for the purposes of the Boards, thus in effect putting the burden on those who could use the supply but do not.

Another powerful aid to success lies in the activity of the Boards in overcoming difficulties due to the cost of wiring, motors, or other initial outlay required by the consumers At the present time in this country few other causes can be restricting electrical development so much as the reluctance or inability of potential consumers to meet the first cost of installation. In the New Zealand hire-purchase schemes the Boards even offer that the transaction shall be confidential, showing that they have reached a pitch of commercial acumen which one seldom associates with organisations of this character; what a contrast to the practice of many of our own undertakings, which still ask for heavy connection charges to premises close to their networks, or even suggest that the would-be consumer should canvass for others in the district!

The following extracts are taken from a number of interesting examples of publicity and application matter issued by some of the New Zealand Boards, and only touch those points which appear to be unusual in British practice, and, together with the rates charged, likely to prove interesting or suggestive to engineers in this country:—

Conference of the Association of Electric Power Boards, New Zealand, 1923.

Extracts from an Address by the Minister of Public Works.

During the five years which have elapsed since the passing of the original Act, 31 Boards have been constituted, and 10 are actually carrying out the distribution and sale of energy.

In the last year, 10 Boards levied general rates ranging from 0.04d. to 0.65d., but only in five cases was the rate collected, amounting to about £7,400.

The Department assumes the responsibility of fixing maximum prices, usually 9d. or 10d. for lighting and 4d. or 5d. for power and heating (retail charges). To wholesale consumers guaranteeing over £180 a year, the maximum is usually ½d. per kWh, plus a fixed charge, which in the case of Boards purchasing energy in bulk is £12 per kVA-year, and in the case of Boards operating their own power stations £16 per kVA-year. Within these limits the Department leaves Boards free to fix their own retail and wholesale charges.

It is understood that the charges cannot be uniform in all districts, but it is hoped that uniformity will be approached as nearly as possible. The Minister suggested that the Association should tabulate all forms of retail charges in a standard scale, giving half-a-dozen alternatives which the different Boards could select from to suit themselves, with, perhaps, discounts of 5 to 25 per cent.

The 31 Boards gazetted covered about 47,000 square miles, or 45 per cent. of the area of the Dominion, and catered for a population of 582,000, or 47½ per cent. of the population of the Dominion.

New Zealand Public Works Statement, 1923.

Extract from the Annual Report of the Chief Electrical Engineer.

Throughout the Dominion during the year there has been a shortage of power which has restricted industrial development, but the use of cheap hydro-electric power in gold dredging is reviving that industry.

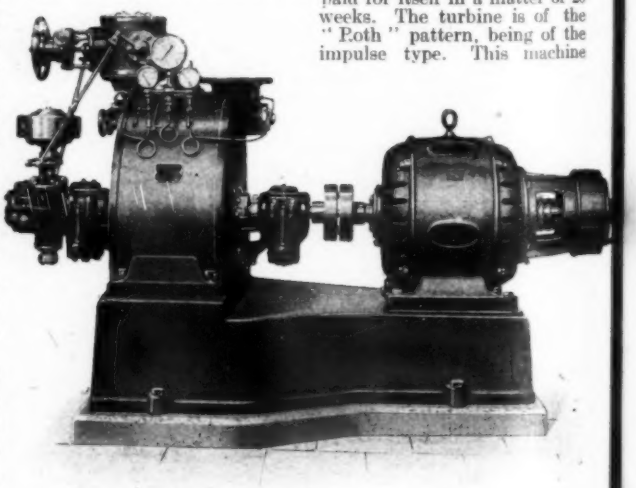
Electric milking plants form a large proportion of the country load of the Power Boards; there are now 1,100 installations in use in the Dominion, an increase of about 100 per cent. in the year. There are 12,468 milking machines in the Dominion, a total increasing at the rate of 2,000 a year, most of which are at present operated by benzine engines.

There are many dairy factories, also butter and dried milk factories, and over 50 killing and freezing works. A freezing works with a killing capacity of 5,000 sheep per day requires from 250 to 300 kW during the season and from 500,000 to 800,000 kWh a year.

(To be continued.)

"Roth" Small Turbines.

The small turbo-generating set illustrated below was supplied to a firm of photographic paper manufacturers near Paris, who required a considerable amount of low-pressure steam for process purposes. Formerly, this steam was taken from their boilers through a reducing valve, while the electricity supply to the works was taken from the local electricity company. Now, however, steam is supplied to the turbines at a pressure of 145 lb. per sq. in. and delivered to the drying machines, entirely free from oil, at a pressure of about 35 lb. above atmosphere. The set, which has a capacity of 50 kVA, generates ample electricity for the works, and the installation paid for itself in a matter of 20 weeks. The turbine is of the "Roth" pattern, being of the impulse type. This machine



A 50-kVA "Roth" Turbine and Generator.

is made in three designs. The "TV" type has radial injection, the steam acting three times on the rotor blades; this is effected by suitably-designed return ducts or canals arranged in the turbine casing. This design is employed to operate centrifugal turbine pumps and ventilating or other fans. A fan coupled direct to a turbine forms an excellent speed regulator, as the resistance of the fan varies directly as the cube of the speed. In such cases it is not necessary to provide the usual speed governor.

The Roth "TD" turbine is essentially designed for coupling direct to an electric generator. It is also an impulse machine, but in this case the passage of the steam is parallel to the axis of the machine. The rotor is normally fitted with two

rows of blades. The steam jet, after impinging on the first row, passes through stationary guide blades from which it is directed, axially, against the second row of rotor blades and thence to the exhaust. The "TD" machine is fitted with a vertical governor capable of maintaining a high degree of regularity. The oil pump for supplying the bearings is driven from the lower end of this governor spindle.

The third type, the "TP," is designed particularly for coupling direct to centrifugal pumps. Where the pump delivers against high pressure, as in the case of boiler feeding, these machines are fitted with a hydraulic governor which co-ordinates the pressure of water on the pump delivery with the pressure of steam on the turbine inlet. This hydraulic governor is capable of maintaining the pressure of the water within two or three pounds of the boiler pressure. Roth turbines are manufactured and sold in Great Britain by Messrs. Scott & Hodgson, Ltd., of Guide Bridge; their London representative is Mr. Chas. E. Douglas.

Correspondence.

Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Lead-covered Wiring and Visible Bonding.

We have followed with keen interest the correspondence on this subject, because 90 per cent. of our contracts are for the lead-covered system. We have been installing this system for a number of years in all classes of buildings, during which time we have tried all kinds and combinations of various systems, and have proved that Callender's "Kaleeco" system is the best. We have never had any trouble, even with installations completed several years ago. A short time ago I tested an installation that we completed five years ago in lead-covered wire (35 points); I made a test for continuity from the farthest point, and the resistance of the sheathing was nil. The needle of the ohmmeter was stationary at zero. I contend that visible bonding is not essential, for a really good job can be made with "Kaleeco." I agree that there is an evil, and to stop that evil you have to remove the cause or else that evil will continue. This evil is the shoddy "electrical" (?) contractor—the real bugbear of the electrical trade. He can be exterminated on this system of wiring simply by the supply company insisting on a test being made for continuity. This would not only help the genuine contractor, but it would mean more customers for the supply company's mains.

I will quote you an instance: A gentleman came to see me about an electric lighting installation. He wanted a good job at the lowest possible cost. I suggested the lead-covered system, but he refused to have anything to do with it. He said he had had one of his houses wired with it, and it had never been right since it was done. As he was not prepared to have anything but screwed tube, and that would not be able to be installed for another 12 months, when he intended to have the house decorated, the supply company lost a customer for that period. No! it is not visible bonding we want, but the evil of the shoddy contractor exterminated.

The Manager,
The Green Electrical Engineering Co.

Jersey, *March 14th*, 1925.

We note the remarks of your correspondent, Mr. Harry Moss, in your current issue, with regard to our boxes. It is apparent that this gentleman is not in possession of our catalogue, and has only seen the small type, originally introduced, owing to the demand for neatness in connection with surface wiring in private houses, and this box is, we contend, admirable for the purpose intended, the bottom portion being very shallow to facilitate jointing. We have several larger types, and may say that the sales of our "Universal" box have been far in excess of our anticipations; this box is approximately to B.E.S.A. dimensions, 2¾ in. by 1 in. internal, and gives ample room for all ordinary purposes. It can be fitted with a metal cover and used as a junction box, or a ceiling rose, pendant plate, hook plate, or switch can be mounted thereon if desired. The bonding nipples can be varied in size and interchanged to suit twin or triple 1/.044, 3/.029 or 3/.036 cables.

We should like to send Mr. Moss a sample of the above box, also details of the still larger types which we can supply from stock.

The Walsall Hardware Mfg. Co., Ltd.
C. G. MAISEY.

London, *March 21st*, 1925.

Free and Hire-purchase Wiring.

I was present at the E.D.A. meeting at the Caxton Hall on the 13th inst., and was very much interested in Mr. Hardie's paper, where he outlined the results the Glasgow Corporation had obtained from the experiments which it had been carrying out on the free wiring of houses, and the wiring of houses on the hire-purchase system. Surely the results obtained are so satisfactory that something drastic should be done whereby the whole of the electrical industry throughout the British Isles can take advantage of similar plans.

It was interesting to hear that several electricity undertakings had been doing this kind of work for several years, and the expressions generally showed that they were all successful, although the schemes had been more or less local and carried through in a small way.

I believe that the present moment is an ideal opportunity for a company to be formed with large capital resources to carry out this type of work throughout the British Isles, utilising the best advertising mediums, such as the *Daily Mail* and other similar publications to broadcast to the public generally the fact that they can have electricity in their homes at practically no initial outlay: all that it would be necessary for them to do would be to pay an additional small hire-purchase rental for their house wiring on the electricity bills. It should not be a difficult matter to make arrangements whereby the electricity undertakings would collect these amounts and so protect the company that is doing this good work against loss. For over two years I have been working out a plan of this kind, and the details are now completed.

To the electrical industry as a whole such a plan, whereby tens of thousands of extra homes would be wired, would be a tremendous boon—to the manufacturer, to the electrical contractor, and to the central station additional revenue would accrue, and the electrical industry would quickly be put on a very much better footing than it is at the present time.

I would like to point out particularly that the electrical contractor in the plans that we have worked out is the one that will most favour this, for all of the work would be done by responsible concerns throughout the country and not by the proposed new company, which would be more or less acting as the financial agents.

L. G. Hawkins.
L. G. Hawkins & Co., Ltd.

London, *March 18th*, 1925.

The Dimensions of Commutators.

Mr. Thomas Carter will have the thanks of many designers for his article on the determination of the size of commutators. The conciseness and clarity of the treatise will make it of great assistance to those who are constantly confronted with commutator troubles and problems.

I have, however, always been of the opinion that the electrical characteristics of the machine itself had a close bearing on the heating of the commutator, and I was therefore somewhat disappointed to find that Mr. Carter omitted any reference to this effect.

That the electrical phenomena do play an important part in the heating of the commutator appears to be confirmed by the discrepancies noted between the temperature rises calculated on the basis of Mr. Carter's formula and actual results.

A particular instance is before me in which the values are as follows:—$C = 415$, $D = 9.375$, $L = 7$ in., $N = 800$, $S = 1960$, $U = 1.7$, $P = 1.75$, $\mu = .17$ $\Delta = 45$. From Mr. Carter's curves $\lambda = .47$, $\sigma = .58$. The expected temperature rise is 73 deg. F. The test had to be discontinued after 2 hours, when the temperature rise measured by thermometer was 151 deg. F.

The grade of brush was then changed, a purely graphitic brush being replaced by one containing a fair percentage of copper. P remained at 1.75, U became .7, and μ increased to .18. The calculated rise should be 36 deg. F: the tested rise was 51 deg. F.

Values of U and μ are from maker's tables, but if on the optimistic side should not make the difference indicated. It would perhaps assist to elucidate the problem if a few details of the machine were given: The armature was wound "4 circuit single" with equaliser connections—a standard construction. There were four lines of brushes (a 4-pole generator) with six brushes per line, the brush being ¾ in. square. Number of commutator bars 84 (one armature turn per bar). The voltage was 40.

Had I judged the reliability of Mr. Carter's statements on this particular example I'm afraid I should have classed them with many other conscientious but misleading articles which have appeared on this subject. Fortunately, however, I first applied the formulæ to a number of machines of widely varied sizes and found a remarkable agreement between the predicted and tested results.

S. Henderson Haynes.

Manchester, *March 18th*, 1925.

The I.E.E. Papers.

With regard to the letter from Messrs. S. A. Knight and M. G. Say, in your issue of the 13th inst., I note that these gentlemen are careful to state that the views expressed in their letter are "not claimed to be anyone's besides their own." I stated in my letter in your issue of February 20th that, in my opinion, "the highly technical papers read before the I.E.E. are neither appreciated nor understood by more than about 2 per cent. of the members." It would seem that I have been fortunate in discovering the two out of 100 who *do* appreciate such papers. I have, however, been equally fortunate in meeting the other 98 who agree with your editorial note on the subject and my brief comments upon it in the REVIEW of February 20th.

Your correspondents are not correct in assuming that my letter referred in any way to Prof. Miles Walker's recent paper on "Harmonic Analysis." Elementary mathematics and calculus, not to speak of abstruse mathematics, are all right in the I.E.E. *Journal* and similar publications, but I still maintain that the average engineer does not go to Institution meetings to listen to formulæ; he can digest these better at home. I recently had the pleasure of hearing Major E. I. David reading his paper on "Electricity in Mines" before the North-Eastern Section of the I.E.E., and I particularly noticed that the author took the mathematical formulæ as read, and confined himself to the practical side of the subject, eliciting an exceptionally interesting discussion, from both technical and practical engineers who knew their subject from A to Z. I almost feel inclined to withdraw my objection to the repetition of one member's paper as many as 10 times, if the much-repeated papers had the merits of Major David's most practical and interesting contribution. At the same time, I am still of the opinion that the younger members should be encouraged to submit papers more than they seem to be at present. I trust I have not unduly trespassed on your valuable space, but I think the subject is of considerable interest to the majority of your readers.

R. Martill Wilson, A.M.I.E.E., M.I. & S. Inst.

Consett, *March 14th*, 1925.

Inaccurate Terminology.

Here are extracts from advertisements by two well-known wireless manufacturing firms in a weekly wireless paper:—

"The charging rate being 2½ to 3 amperes *per hour*, a 6-volt 50-*ampere* accumulator will be charged in about 20 hours."

"—— Valves consume .3 of an amp. *per hour*."

The fact that the advertisers appear to consider the ampere as a quantity comparable with the coulomb, instead of as a rate of flow, will, to say the least, not impress anyone having an elementary knowledge of electricity with a great idea of their technical reliability. Attention was drawn to these howlers without result.

A. O. Griffiths.

Caergwrle, *March 16th*, 1925.

Unlagged Steam Traps.

A remark made to me the other week—what an awful waste of steam—was by one of the contractors' young men when he heard the very frequent blowing through of some traps of the float type to atmosphere (in that instance).

It has occurred to me how very few drain pipes from steam ranges to traps are lagged over—in some stations, perhaps, 5 per cent. maybe; and the smaller the pipes the greater is the cooling surface compared with the amount of steam or water in the pipes. So that the pipes and traps function as condensers to some considerable extent in a twelve-month, causing loss of latent and sensible heat. I do not recollect ever seeing a trap of the float type lagged over, but see no objection to its being done provided that the saving in heat covers the cost. Some trap pipes are 40 or 50 feet in length, with a difference in temperature of 400 deg. F. or 500 deg. F. between the steam and the surrounding air.

W. E. P.

March 17th, 1925.

Low-fall Hydraulic Turbine Installations.

The description given by Mr. Cock, of the low-fall turbine plant at Christchurch, following as it does the account of the opening of the Ringwood hydro-electric station, is of great interest to anyone knowing the district. When one considers the wastage of water-power which has been going on for years, in the numerous mills along the banks of the Stour and Avon, one wonders how much longer this wastage will be permitted to continue. The machinery in these mills is driven by cumbersome undershot wheels of low efficiency, which, if replaced by modern hydro-electric plant, designed for low fall, would not only supply the mill machinery with a more elastic system of power transmission, but could supply electrical energy for lighting purposes in the villages surrounding the mills, which, in many cases, have no gas supply. There can be no doubt that similar wastage of water-power is occurring on many small rivers in this country, and that the development of low-fall hydro-electric plant in these cases would minimise to a great extent our natural shortage of water-power.

Arthur F. Newbery.

Birmingham, *March 20th*, 1925.

Maxtorq Motors.

Our attention has been called to the article you have written on the electric driving of large spinning mills. On page 460 there is the following sentence referring to our Maxtorq motors:—

"We have in fact seen one of these motors actually running with the ends of the bars red hot and functioning perfectly."

This sentence may give rise to some misconception on the part of your readers, and we should like you to amplify the statement.

The paragraph refers to a test that we have carried out on a Maxtorq motor in our own works on many hundreds of occasions. The rotor is locked and the full voltage applied for five minutes until the end connections of the rotor become red hot. This motor is normally lifting a 2-ton load on a winch, and after the test mentioned above we prove by running the motor that it has not been affected in any way.

We think this is a striking demonstration of the robustness of the Maxtorq motor, and are prepared to repeat this test to any interested readers at our works. We claim that no other motor will stand this severe test.

The Lancashire Dynamo & Motor Co., Ltd.
A. P. Wood, *Managing Director.*

Manchester, *March 21st*, 1925.

[Certainly we did not intend to convey the impression that the rotor bars were ever red hot when running under normal conditions! The feat was performed, as stated above, purely for demonstration purposes, under the abnormal conditions described.—Eds. Elec. Rev.]

Electric Forces and Quanta.

I have just read, in "Supplement to *Nature*," dated March 7th, the report of a most interesting Kelvin lecture; and there is one statement to which I venture to call attention:—

"A being who was born without any one of his five senses, but with unlimited reasoning powers, could deduce the general nature of the actual world without any experience of reality."

I submit, with very great respect to the learned lecturer, that acquired characteristics, such as reasoning powers even of a limited kind, cannot be transmitted; and that a being born without any one of his five senses could deduce nothing. Such a being would not be aware of his own existence—except in regard to hunger and thirst and their satisfaction if anybody "fed the brute," and to such bodily functions as are necessary for keeping him alive.

W. H. Massey.

Twyford, *March 19th*, 1925.

The Status of Engineers.

Surely this is the "unkindest cut of all": "All the world over, a man may recognise an engineer. He carries an oily rag. It has become a symbol of his profession, his badge of office, the sign manual of his ancient mystery."

This is an extract from the opening paragraph of an article in a big London daily paper.

Wm. Rexter Good.

London, *March 20th*, 1925.

[A deplorable libel, indeed; but a writer who does not know the meaning of "sign manual" is not likely to know that a mechanic is not an engineer, or even that verbiage is not literature.—Eds. Elec. Rev.]

Aeroplane Crashes and Ignition Circuits.

Considerable interest, and probably discussion, will be aroused by the article under the above heading contained in your current issue. The undersigned contends, for reasons given below, that the argument of your contributor is baseless.

The two methods of connection of ignition generators cited correspond to auto and separate secondary windings in the case of an ordinary transformer. In the "incorrect," or auto, case, the primary must be regarded as a portion of the complete secondary, providing, as it does, some small portion of the total secondary voltage. In the "correct" or non-auto case, the secondary voltage is dependent upon its own number of turns alone.

The undersigned's reasons for questioning the validity of the argument are as follows:—

(1) Quite the majority of battery ignition systems, and, so far as he knows, all ordinary magnetos (double spark and other special magnetos excepted) are connected in the manner of figs. 2 and 3 of the article respectively.

(2) All aeroplanes to which this article is relevant are fitted with separate complete dual ignition systems; they would not otherwise be considered airworthy. The present-day rarity of single ignition failure renders the possibility of simultaneous double ignition failure exceedingly remote. Of dual ignition your contributor makes no mention.

(3) His technical conclusions are very questionable. Referring to his fig. 2, it must not be overlooked that the battery end of the primary is earthed, so far as high-frequency alternating currents are concerned. The primary and secondary wound in series together constitute the complete secondary, and their respective induced voltages are substantially *pro rata* with the number of turns. There does not appear to be any reason why, on that terminal of the primary coil in connection with the condenser, such excessive potential as the writer suggests as being due to the mode of connection can exist in the one case (fig. 2) any more than in the other (fig. 1).

To account for the existence of such excessive potential in the one case and not in the other, it would be necessary

to suppose that somehow the "auto" connection resulted in the primary receiving a stimulus at an equivalent frequency considerably higher than that of the fundamental operating frequency of the coil in producing the initial secondary spark.

Though it is not impossible that such high-frequency stimulus may exist, *e.g.*, as a result of harmonics in the fundamental oscillation due to core hysteresis or non-linearity of h.p. spark gap characteristics, again there appears to be no reason why this should lead to a result materially different in the one case from that in the other, it being always remembered that the primary and secondary in each case are together wound on the same core and subject to the same flux changes.

(4) Your contributor appears to have overlooked the fact that the existence of a much larger potential at this point in the one case than in the other implies a still larger difference in the momentarily stored energies of the condenser, these energies being proportional to the square of the voltage. It being a fact that in normal running a large percentage of the energy given by the battery per break is momentarily stored in the condenser, whence would come, in the one case as compared with the other, the additional supply of energy to charge up the condenser to the much greater potential supposed? The writer's statement that the inductance of the primary coil effectively prevents the passage of the major portion of the secondary current appears to be quite erroneous, the primary actually being part of the secondary as regards this functioning.

(5) Utilising a suitable rectifying valve and an electrostatic voltmeter, it is possible to measure the maximum potential at the point in question, and though the undersigned has not personally made this experiment, he has little doubt that the result would show no material difference in the magnitudes of the maximum potentials observed, *ceteris paribus*, in the two cases.

The undersigned is of the opinion that the difference in construction costs between the "correct" and "incorrect" methods of connection is not so small as the writer of the article suggests.

Finally, with reference to "the theoretical error," which "in practice causes no trouble," may we point out that, especially in electrical science, the admission of a measure of difference between theory and practice is the admission of an equivalent measure of ignorance. All theory is based upon practice in the first instance, and any tendency to divorce the two is to be deprecated.

E. Fowler Clark, B.A., B.Sc., A.M.I.E.E.,
Electrical Engineer to Messrs. Rolls-Royce, Ltd.
Derby, *March 17th*, 1925.

Reviews.

The Wireless Annual for Amateurs and Experimenters, 1925. Pp. xlviii+196. Illustrated. London: Wireless Press, Ltd. Price 2s. 6d. net.

This is the second year of the "Wireless Annual," and this number will be found even more useful to the amateur than that of last year.

The early days of wireless telegraphy are described in interesting articles by Mr. Marconi and Professor Fleming, while up-to-date technical matters are dealt with by Captain Round, Captain Eckersley, and other well-known radio engineers. Captain Round's article on Microphones is an excellent summary of present knowledge on the subject.

The tabular and reference matter, all of great interest to amateur experimenters, which appeared last year, has been brought up to date, and a list of call signals of liners trading regularly with this country has been substituted for the less useful list of land stations included last year.

New features are descriptions of component apparatus, a directory of manufacturers, and a list of trade marks and trade names.

The position and nature of service of the land stations of the world are well set out in a series of 35 maps.

This annual should prove of great value to experimenters and to the large body of listeners who, though not experimenters, are interested in the progress of the art.

Wireless Working Hints for Beginners. By ARCHIBALD WILLIAMS. Pp. viii+94; 58 illustrations. London: Percival Marshall & Co. Price 1s. 6d. net.

The object of this book is to assist the ordinary listener who wishes neither to carry out experiments nor to construct his set, but who does wish to form an intelligent opinion of what sort of set to procure and how to get the best out of it in practice.

With small books of this class it is usual to avoid the theory of the subject, but Mr. Williams, though careful to do this in the main, has happily touched on fundamental conceptions sufficiently to save the book from being included in the dry rule-of-thumb category too often inflicted on the unwary novice. The uninitiated reader of such books must wonder how a set ever works at all with so many troubles surrounding it, but if he gets a set he will find this little book will smooth over many difficulties, and, after all, it is very easy to get really good results, though not quite the best, from a good set.

The book deals shortly and simply with aerials, earths, valves, headphones, loud-speakers, batteries, operating and selecting receivers, and gives the waves, call signals, and the distances from London of the principal British and Continental broadcasting stations.

"A Wise Fool." By EDWARD CHARLES REED. The John Long £500 Prize Novel (1924). London: John Long, Ltd. Price 7s. 6d. net.

This original modern novel is composed of three simultaneous romances, the most delightful being that of a little Swiss waiter and his wife. Among some very good character studies, that of the "wise fool" stands out as the most human and most lovable. Introduced late into the story, and by his very nature frequently retiring into the background, he is not easily recognised as the hero, and were he told of it, he would probably wave his arms aimlessly and exclaim "Good Lord!" With his clumsy incoherence he forms a striking contrast to his friend, an Australian multi-millionaire, the man who never made a mistake. The story has a charm of its own, and many vivid descriptions benefit by the author's Continental education.

Although this is Mr. Reed's first novel, he has published several poems and short stories, and is a voluminous contributor to the technical Press on boiler-house efficiency. He has been for 12 years manager of the publicity department of Messrs. Edward Bennis & Co., Ltd., and was formerly chief publicity writer for the British Westinghouse Co.

Electrical Machinery and Control Diagrams. By TERRELL CROFT. Pp. xii + 305; figs. 570. London: McGraw-Hill Publishing Co., Ltd. Price 15s. net.

This book consists solely of line diagrams of connections of different types of electrical apparatus.

The divisions of the book are—

1. Alternating current generators.
2. Direct current generators.
3. Transformers.
4. Synchronous converters.
5. Motor generators.
6. Alternating current motors and control apparatus.
7. Direct current motors and control apparatus.
8. Instruments.
9. Miscellaneous.

The diagrams are drawn from all sources, but the principal supply comes from American manufacturers' catalogues.

In each section there are diagrams of very considerable interest to specialists, but the reviewer cannot conceive of anyone who is familiar with the fundamental principles of electrical engineering having any use for the majority of the figures.

The book is very well produced and the figures for the most part are perfectly clear. The reviewer, however, recommends that prospective purchasers should examine the volume for themselves to ensure that it meets with their requirements, as the examples follow too closely American practice to be directly applicable to British apparatus.

Drawing-Office Practice. By H. PILKINGTON WARD, M.Sc. (Vic.), A.M.Inst.C.E. Pp. vii+148; figs. 18. London: Sir I. Pitman & Sons, Ltd. Price 7s. 6d. net.

Innumerable books have been written on the subject of machine drawing, and it is pleasing to know that this book does not add to their number. Most books on machine drawing, however, deal to some extent with drawing-office practice, and it is seldom possible to say that they are satisfactory on that branch of the subject, and therefore a work dealing entirely with the practice of drawing-office lay-out and routine is to be welcomed.

The author has based his conclusions on the methods of many drawing offices, particularly those dealing with the design of large steam engines for power stations; electric generators; and general mechanical engineering in steam, hydraulics and compressed air. The object of the book is to give an outline of the present-day practice in drawing-office methods, and to enable the reader to realise the functions of the drawing office in an engineering works, and also the knowledge and training required by the staff to carry out this class of work in an intelligent and efficient manner.

It is pointed out that no one system or series of systems can be worked out in detail in any book to suit the varied conditions obtaining in different establishments, and although systems can be discussed it is essential to build up a system to suit the requirements of each individual case. It is obvious that all systems should be as simple as possible, and that all redundant and unnecessary operations should be rigidly excluded.

The function of the drawing office is divided under three heads—design, routine, and record; each of these three important branches of drawing-office work is fully considered from every point of view. The introduction gives an outline of the work done and its connection with other departments. A use-

ful chapter for those who are establishing a new drawing office deals with office arrangement and furniture, and, although only applicable to a large office, can be modified to suit the required conditions.

Drawing office appliances, instruments, and materials, take up a rather long chapter, and the information given is common to most books on machine drawing. The most useful and important part of the book deals with routine, filing, and indexing, and the procedure recommended is undoubtedly based on good modern practice and will commend itself to all responsible draughtsmen.

A number of useful rules are given for dimensioning drawings, and these are well worth following out. They are: 1. Each dimension must be shown once and only once, however many views of the part are made. 2. Dimensions relating to one another should be grouped together. 3. Dimensions should be given on the side view and not on the circular view. 4. Each part should be dimensioned definitely and precisely. These rules are given in the chapters on drawing procedure and convention, and other chapters deal with the arrangement and types of drawings, tracings, checking, and the print room.

The book is written by a practical draughtsman who thoroughly knows his subject, and it can be confidently recommended to all draughtsmen, particularly those holding, or likely to hold, responsible positions.

E. P.

Alternating-Current Rectification. By L. B. W. Jolley, M.A.(Cantab.), M.I.E.E. Pp. xviii + 352; figs. 244. London: Chapman & Hall, Ltd. Price 25s. net.

The important nature of this work makes it allowable to describe it rather more fully than is customary in reviewing.

The book covers in a general way the whole field of the rectification of alternating currents.

There are six main divisions of the book:—

1. Wave form.
2. Mechanical rectification.
3. Gaseous conduction.
4. Liquid conduction.
5. Wireless rectifiers.
6. Alternating-current measurements and voltage regulation.

The section on harmonic analysis will be quite light reading for an honours graduate, but will prove a stumbling block to most electrical engineers. The treatment is somewhat abbreviated, but it is supplemented by a fairly complete bibliography.

The section on mechanical rectifiers is very interesting, but it reveals the fact that the author is very much more familiar with small machines than with large ones, the treatment of the latter class being rather superficial.

The section on gaseous conduction gives a brief outline of the subject of the conduction of electricity through gases, followed by the theoretical and practical aspects of mercury vapour rectifiers and vacuum tube thermionic rectifiers. It is extremely interesting throughout, and contains a great deal of information which is not readily accessible everywhere. Wherever possible, the subject is developed quantitatively and in addition to the underlying mathematical theory, actual arithmetical values obtained by eminent experimenters are given, the sources of empirical constants being stated in all cases.

The subject of liquid conduction and electrolytic rectification is handled in the same systematic manner although, of course, the space required is in this case much more restricted.

The section on wireless rectifiers is extremely condensed, but this is by no means a defect.

The concluding section on alternating-current measurements and voltage regulation consists merely in a note on the utilisation of the highly sensitive direct-current instruments of the d'Arsonval type for the measurement of small alternating currents and voltages. Mr. Jolley states that indicating dynamometer instruments can be obtained which will read to 10 milliamperes or 0.2 volt, but that the use of these is often inadmissible on account of their low resistance. So far as the reviewer is aware, it is quite impossible to make a low-resistance alternating-current milliammeter, and the defect of such instruments is excessive resistance. An alternating-current dynamometer voltmeter reading 0.2 volt would probably require a current of somewhere about half an ampere to operate it, and in this case of course, the resistance would be low.

The book throughout bears the stamp of Cambridge, from the Greek dedication to the differential equations. The influence of Cambridge has, however, been insufficient to eliminate the split infinitive. The thoroughness of the book and the lavishness of references to supplementary volumes and papers show that the author is poles apart from Henry Ford, who believes that written records of experimental research are quite valueless and should be destroyed. The question of choosing between the two types must, however, be left to each individual to solve for himself.

The work of the printers and publishers is excellent and the book is, on the whole, one of the very best which have passed through the hands of the present reviewer.

Business Notes.

Bankruptcy Proceedings.—T. N. Shepherd, 15, Bridge Road, Stockton-on-Tees, and 5, Queen Street, Redcar, Yorks., plumber and electrical engineer.—The first meeting of creditors was held on March 13th at the Official Receiver's offices, 80, High Street, Stockton-on-Tees. It was stated that debtor's statement of affairs had not been sworn, but the liabilities were expected to be about £12,000, whilst the assets were estimated at approximately £8,000. The creditors resolved to appoint Mr. Charles Turner, 155, Norfolk Street, Sheffield, as trustee of the estate and a committee of inspection was also nominated.

Alfred Allen, trading as A. Allen & Son, 26, Augusta Street, Birmingham, lately trading at Hockley Street, Birmingham, toolmaker, stamper and piercer.—The first meeting of creditors was held on March 13th at the Official Receiver's Offices, Birmingham. According to the statement of affairs there was a deficiency of £376. Debtor attributed his failure to losses incurred on three patents, bad trade, keen competition, and ill-health. He stated that he lost about £150 on the patents, while owing to trade depression and competition during the past two years, the manufacture of wireless accessories in which he specialised ceased to be profitable. The matter was left with the Official Receiver as trustee of the estate.

Philip Barnard, 9, Savoy Street, Strand, W.C., dealer in radio accessories, &c.—The public examination of this debtor was held on March 18th, before Mr. Registrar Hope, at the London Bankruptcy Court. He failed last November with liabilities £2,113, against assets valued at £762. In the course of his evidence the debtor stated that he originally commenced business in January, 1921, with a capital of £850, as a tool merchant. In December, 1923, he commenced a retail business in wireless accessories. The profits since that time had been insufficient to meet general expenditure, owing to trade depression and heavy overhead expenses. The examination was concluded.

S. Holmes, 5, Gibson Street, Burmantofts, Leeds.—Last day for proofs for dividend, April 6th. Trustee, Mr. H. C. Bowling, Official Receiver, 24, Bond Street, Leeds.

R. D. Barns, lately trading as "The Finchley Road Wireless and Electrical Stores," 160c, Finchley Road, N.W. The public examination of this debtor took place at the London Bankruptcy Court, on March 18th, before Mr. Registrar Hope. The debtor failed last November owing £987 and returned as the only asset a bad book debt of £100. Questioned by the Official Receiver, debtor stated that he began business in November, 1918, as a motor engineer. In January, 1923, with £20 he started as a dealer in wireless accessories and traded until January, 1924, when having exhausted his stock and his credit having been stopped, he abandoned the business. Lack of capital, depression in trade and family illness were the reasons assigned for the failure.

W. T. Ellis and C. A. Hornsby (Ellis & Hornsby), electrical engineers, Gwynfryn, Deganwy Avenue, Llandudno.—Last day for proofs for dividend, April 1st. Trustee, I. D. Hooson, Official Receiver, St. Peter's Churchyard, The Cross, Chester.

E. Owen (E. Owen & Co.), wireless dealer, 1, Senghenydd Road, Cardiff.—Receiving order made March 10th, on creditors' petition.

N. P. Jones, electrical engineer, 23, High Street, Denbigh.—Receiving order made March 12th, on debtor's own petition.

C. Benns (United Electrical Co.), electrical engineer, 55, Lowgate, Shipley, Yorks.—First meeting held March 25th, at the Official Receiver's office, 12, Duke Street, Bradford. Public examination, March 30th, at the County Court, Bradford.

A. Donoghue, electrical wireman, 11, Rutland Avenue, Burnley.—First meeting, April 1st, at the Official Receiver's offices, 11, Winckley Square, Preston. Public examination, April 21st, at the County Court House, Burnley.

G. W. Ridley (G. Ridley), electrical engineer and contractor, 1, Alfred's Court, Chorley, Lancs.—First meeting, March 27th, at the Official Receiver's offices, 11, Winckley Square, Preston. Public examination, April 17th, at the Sessions Hall, Preston.

A. C. McCallum (A. C. McCallum & Co.), electrical engineers, 108, Woodlands Road, Glasgow.—Estate sequestrated by the Sheriff of Lanarkshire, at Glasgow, March 17th. Meeting to elect trustees and commissioners, March 27th, at the Faculty Hall, Glasgow. Agent, Mr. T. Armstrong, 24, St. Vincent Place, Glasgow.

Company Liquidations.—Weston Electric Lighting Co., Ltd., Bolton.—A meeting of creditors was held recently, at the offices of Mr. J. Greenhalgh, the liquidator of the company. A statement of affairs was submitted which disclosed liabilities of £422, of which £419 was due to unsecured creditors, and there were preferential creditors in respect of wages amounting to £3. There were total assets of £235, or an estimated deficiency of £187. It was reported that the company was incorporated on February 13th, 1924, with a nominal capital of £1,000, of which £600 was issued, to take over the liabilities and assets of a partnership concern. The company had little, if any, working capital at the date of its inception. One of the directors was a creditor for £114, being in respect of £65 paid

to the bank in respect of an overdraft, and the balance was for cash advanced from time to time. No resolutions were passed, and the matter therefore remains with Mr. Greenhalgh as liquidator. The following are among the creditors:—

	£		£
Barlow, John	114	Electric Supplies, Ltd.	80
Falk, Stadelmann & Co., Ltd....	22	Castle Engineering Co.	40
Moss & Smith	25	Greenhalgh, J.	25

BOWER ELECTRIC, LTD., manufacturing electrical, and radio engineers, 15, Grape Street, Shaftesbury Avenue, W.C.2.—A meeting of the creditors was held on March 18th at the Holborn Restaurant, W.C. The chair was occupied by Mr. F. E. Kewley, the receiver for the debenture holders, and one of the liquidators in the voluntary liquidation of the company. The statement of affairs disclosed book assets of £18,162, but they were only estimated to realise £6,194, from which had to be deducted £753 for preferential claims, leaving a balance of £5,441. That amount was insufficient to meet the amount due to the debenture holders of £5,960. The issued share capital was £28,809, and the claims of the unsecured creditors totalled £70,768. The total deficiency was £40,036. For the purposes of the statement no value was placed upon the goodwill, which appeared in the books at £2,433. There was also unissued capital to the extent of £1,000. The chairman reported that the company was registered on October 17th, 1922, to take over, as a going concern, the business of J. B. Bower & Co., paying the vendor £14,000. The company had a paid-up capital of £28,800. The amount due to the vendor had not been fully discharged, and the sum due would have figured at a much larger amount in the liabilities but for the fact that the late managing director (Mr. J. B. Bower) voluntarily gave up his claim to the extent of £4,000. At the present moment the balance due to the vendor was £2,359, and that sum was included in the liabilities. The issued capital of the company was obtained from investors, some of whom were appointed directors while others were given positions with the company. Positions were given to investors without having sufficient regard to the fact that there might not be positions for them to fill. Investors of £2,000 were made directors and given service agreements at £7 a week. Other investors were given positions in the office and works at salaries ranging from £4 to £6 per week. The consequence was that the overhead expenses were entirely out of proportion to the business that could be done. The books showed that during 1923 the average turnover was £1,050 per month, whilst the overhead expenses were approximately £80 a week. The gross profits on the lines factored were comparatively small, and a considerable loss occurred during that period. Towards the end of 1923, however, the turnover began to steadily increase, and during 1924 the sales averaged £2,500 per month, but the overhead expenses rose to nearly £200 a week. In January, 1924, the company had the opportunity to obtain the control of a new radio valve which was being put upon the market, and with regard to which very good reports were received. The company obtained the sole control of the sale of the valve. Preliminary tests showed it to be of a very high quality, and an expensive advertising campaign was undertaken, and large orders were obtained. Unfortunately, the manufacturers could not produce the numbers which were required; deliveries were increased, but at the expense of the quality of the valve. Subsequently large numbers of the valves were returned to the company as faulty, and the transaction resulted in a loss to the company of some £6,000. Finally the company disassociated itself from the valve, but the loss did not end there, as some of the valves were placed upon the market by other people and sold at low prices. Some of the valves sold in that way had been returned to the Bower Electric, Ltd., and in order to retain the goodwill of their customers they had been forced to give credit for valves which they had not actually supplied. A company called David Ash & Co., Ltd., was formed in 1923, and it was thought that it would prove a valuable asset, as it possessed concessions from manufacturing firms in Germany. One concession related to a new type of electric motor which it was believed would be taken up in this country, but owing to lack of capital that venture could not be successfully carried through, and there was a serious loss. In 1924 the directors of the Bower Electric, Ltd., and David Ash & Co., Ltd., were persuaded to take up a line of German electrical accessories. Orders for £3,000 worth of those accessories were placed, and it was alleged that when the goods were delivered, after a lengthy period, the prices were not favourable, and that the Bower Electric, Ltd., did not possess the organisation to dispose of the articles in large quantities. The accessories were paid for by bills drawn by David Ash & Co., Ltd., and accepted by the Bower Electric, Ltd. Many of the bills were met, but at the end of January one could not be met, and a receiver and manager of the Bower Electric, Ltd., was then appointed, and the company went into voluntary liquidation, with a view to reconstruction taking place. The chairman added that the company would have made a large profit on the valves if the quality had been maintained and the necessary quantities obtained. The directors had consented to withdraw their claims if the appointment of the joint liquidators was confirmed; that would result in the unsecured creditors' claims being reduced to £5,672. The company had a considerable connection, and the business could be made profitable. During the six weeks in which he had acted as receiver the turnover had been £2,500, with gross profits of 33 per cent., whilst the overhead expenses had been reduced to approximately £100 weekly. Negotiations were taking place for the introduction of fresh capital in order to carry through a scheme of reconstruction. There was a possibility of the scheme going through in the near future, and the company being placed upon a sound basis.

Mr. P. HOUSTOUN, of Messrs. Corfield & Cripwell, said that the chairman had been the general manager of the company, and inquired whether he had favoured the business which had resulted in substantial losses.

The chairman replied that he had advised the board against the deal in German accessories, but it was on his proposition that the valve was taken up. Under other circumstances the valve business would have been very profitable. The debentures were created last November, and had all been issued for cash.

Mr. HOUSTOUN pointed out that some of the debentures were only registered on January 5th last, practically within a month of the decision to wind up.

Mr. HOUSTOUN said that the balance-sheet also had reference to three other companies, of the name of David Ash and Co., Ltd., Revalco, Ltd., and Crystal Engineering Co., Ltd. These companies appeared on both sides of the balance-sheet. On one side they figured as assets, and on the other side as liabilities. Mr. Livesey, one of the liquidators, who had also been the auditor of the company, explained that when preparing the balance-sheet he was unable to get full details regarding the three concerns which had been mentioned, and he therefore created a reserve account on the liabilities side of the balance-sheet.

In answer to a question, the chairman said that under the scheme of reconstruction it was proposed that the business should be sold to a new company called Bower Electric (1925), Ltd., which would have a nominal capital of £10,000. The new company would satisfy all the debts and liabilities of the old concern and also allot shares to the shareholders in the present company. The negotiations were proceeding, but the scheme was in an embryonic state. He hoped to get £25,000 new capital for the business.

Eventually a resolution was proposed by Mr. J. A. Milne, late secretary to the company, and seconded by Mr. J. B. Bower, in favour of the voluntary liquidation being continued by the present liquidators, and of the scheme of reconstruction being carried out. An amendment was moved for an application to be made to the Court for the appointment of Mr. F. Morse, C.A., of Great Winchester Street, E.C., as liquidator in the place of the liquidators appointed by the shareholders, and the amendment was carried.

STAMFORD ENGINEERING CO., LTD., 400, Hoe Street, E.17, electrical and general engineers.—A meeting of creditors was held on March 19th, at the offices of the Society of Incorporated Accountants and Auditors, E.C., when the chair was occupied by Mr. R. Kenneth Crane, the liquidator of the company and the receiver for the debenture holders. The chairman reported that the liabilities amounted to £2,241. The only asset of the company was the cash in the hands of the Liquidator, amounting to £284, which represented the surplus from the debentures. The deficiency as regarded the creditors was therefore £1,958. The dividend would be approximately 2s. in the £. No resolutions were passed, and the matter therefore remains in the hands of the present liquidator. The following are creditors:—

	£		£
Accles & Pollock	40	Mander Bros.	32
Crawford Mfg. Co.	42	Reed, H.	29
Cement Supply Co.	31	Savage, G. H.	25
Chicken, William	47	Van Heyst, J. B., & Sons ...	69
Crane, Houghton & Crane ...	65	Walton & Brown	160
Delta Metal Co., Ltd.	42	Webb, H. C., & Co., Ltd. ...	56
Deakin, William	65	Young, T. W., Ltd.	45
Jones, F. C., & Co., Ltd. ...	78	Stevens, David	380
Midland Tube & Forging Co. ...	154	Stevens, Mrs. R.	475

WALTON'S WIRELESS (NEWCASTLE-UPON-TYNE), LTD., 24, Gallowgate, Newcastle-upon-Tyne.—A meeting of creditors was held on March 16th at the offices of Mr. R. M. Graham, C.A., Newcastle-on-Tyne, who stated that he had been appointed to act as the liquidator in the voluntary liquidation of the company. A statement of affairs was presented, which disclosed liabilities of £715, all due to unsecured creditors. The total assets were £725, from which had to be deducted £45 for preferential claims, leaving net assets of £680, or a deficiency of £35, subject to the costs of liquidation. The issued share capital was £1,750, so that there was a deficiency as regarded the contributories of £1,785. The company was incorporated on August 30th, 1924, with a nominal capital of £25,000, for the purpose of acquiring a wireless business previously carried on by Messrs. Townsends, Ltd. The purchase price was £1,500, of which £750 was paid in cash and the balance in fully-paid shares; the issued capital of the company was £1,750. The turnover since the incorporation of the company had been £798, and a gross loss of £585 had been incurred. It was decided to confirm the voluntary liquidation of the company with the present liquidator.

TREDEGARS, LTD. (Old Company).—Particulars of claims by April 4th, to Mr. B. B. McCallum, one of the joint liquidators, 5, Chancery Lane, W.C.

TINGEY WIRELESS, LTD.—A meeting of members is called for April 21st at the offices of Messrs. Lord, Foster & Co., 37, Walbrook Street, E.C., to hear an account of the winding up from the Liquidator, Mr. A. J. Foster.

RADIOLECTRIC, LTD.—Winding up voluntarily. Liquidator, Mr. A. G. Parker, 2, Coleman Street, E.C.

Norwood Wholesale Fittings Supply Co., Ltd.—First meetings of creditors and contributors, March 27th, at Carey Street, W.C.

Fallon Condenser Manufacturing Co., Ltd.—A meeting of creditors was called for March 24th, at the Holborn Hall, W.C.1.

Private Arrangements.—S. E. Porter, trading as the Rock Electrical and Brighton Magneto Co., 12b, Rock Place, Brighton.—Messrs. Orbell & Kirk, accountants and auditors, 151/152, North Street, Brighton, state that they are now in a position to declare a first and final dividend at the rate of 3s. 4d. in the £. The accounts show that the liabilities totalled £349, whilst the stock was disposed of privately for £50.

A. W. Lotinga, electrical and wireless dealer, trading as the Humber Specialities Co., 25, Midland Street, Hull.—A meeting of creditors was held on March 20th, when a statement of affairs was presented, which disclosed liabilities of £473, of which £398 was due to the trade and £75 to cash creditors. The assets totalled £232, from which had to be deducted £28 for preferential claims, leaving net assets of £204, or a deficiency of £269. It was reported that the debtor commenced business as an electrician in March, 1919, with a capital of £25. He appeared to have traded successfully up to April 5th of last year, when a balance-sheet was prepared, which showed a surplus of approximately £320. The present position was attributed to bad debts and to losses in connection with the radio business which he started. It was decided that the debtor should execute a deed of assignment to Mr. E. P. Dutton, accountant, Hull.

The following are creditors:—

	£		£
Willoughby, F.	20	Metropolitan-Vickers Electrical Co., Ltd.	52
Steel, N. & H.	35	Waite, Mrs.	75
Paragon Rubber Co.	73		
Morley, T. B., & Co.	61		

Dissolutions of Partnership.—J. W. Davenport, plumbers and electricians, 99, Blackburn Street, Radcliffe.—Mr. R. A. Maxwell and Mr. L. Schofield have dissolved partnership. Mr. Schofield will attend to debts and continue the business under the same style.

F. Schofield & Co., mechanical and electrical engineers, 80, Manchester Road, Bradford.—Mr. F. Schofield and Mr. S. Muff have dissolved partnership. Mr. Schofield will attend to debts.

Trade Announcements.—Messrs. T. Hood & Co., Ltd., have removed their offices to 40, Queen's Road, Bristol. Telephone No.: 1867; telegraphic address: "Fuse Bristol."

We announced last week the removal of the head office and London warehouse of W. T. Henley's Telegraph Works Co., Ltd. The telegraphic addresses are now:—United Kingdom, "Henletel, Cent, London"; abroad, "Henleys London." Telephone No.: "City 2271" (ten lines).

In consequence of the increased demand for its products the sales department of the Paragon Rubber Manufacturing Co., Ltd., of Hull, has been reorganised. Messrs. Peter Curtis, Ltd., of 75a, Camden Road, London, N.W.1, have now become the central sales organisation for the productions of the two associated companies so far as these appertain to the wireless industry in general.

The business at 82, Victoria Street, S.W., formerly carried on by the late Mr. S. Utting, and later under the style of "the Successors of the late S. Utting," has now been taken over by the French principals, Société des Cheminées Louis Prat (S.A.) Paris, and is registered under the name of the Prat Draught Co. Recent work executed includes three additional induced draught plants at the Prince's Station, Nechells, for the Birmingham Corporation, while others are being installed at Fulham, Dover, and Maidstone power stations.

The Selson Engineering Co., Ltd., informs us that it has acquired premises in Charles Street, E.C., to which its business will be transferred on June 1st.

Mr. J. B. Rudkin (Sprecher & Schuh Co.) is removing on April 1st from Shaftesbury Avenue to Albion House, 59a, New Oxford Street, London, W.C.1. New telephone No.: "Museum 9470."

For Sale.—Finchley Urban District Council Electricity Department invites offers for one 300-b.h.p. Hornsby oil engine, &c. (See our advertisement pages to-day.)

Indian Orders for Electrical Plant.—The Indian Stores Department has placed an important order with Messrs. Mirrlees, Bickerton & Day, Ltd., for an electrical generating plant for the Salt Mines, Khewra. This consists of two four-cylinder 500-b.h.p. Mirrlees-Diesel oil engines running at 200 r.p.m., and one two-cylinder, 80-b.h.p. Mirrlees-Simplex crude-oil engine (325 r.p.m.), direct-coupled to two 3-phase, 325-kW, and one 50-kW alternators respectively, generating at 3,000/3,300 V, made by the Metropolitan-Vickers Electrical Co., Ltd. The company has also secured an order for the Sukkur Barrage Works for a 263/300-b.h.p. Mirrlees-Diesel oil engine direct-coupled to a 175-kW Metropolitan-Vickers alternator complete with the necessary auxiliaries.

Wages Agreement in Norway.—A great labour conflict has been averted in Norway owing to both parties having accepted the Public Mediator's proposal regarding a new wages agreement. The agreement comprises 25 tariffs, including many of the most important industries, employing 70,000 workers.—*Reuter* (Oslo).

Catalogues and Lists.—The Walsall Hardware Manufacturing Co., Ltd., Ablewell Street, Walsall.—An illustrated and priced pamphlet advertising "Wal-Kall" bonding nipples.

Ateliers de Constructions Electriques de Charleroi, 56, Victoria Street, S.W.1.—Catalogue No. C.C. 226, dealing with the company's d.c. motors and dynamos.

Messrs. Matthews & Yates, Ltd., Swinton, Manchester.—Four pamphlets illustrating applications of "Cyclone" fans, portable acetylene plant, and motors.

Wandsworth Electrical Manufacturing Co., Ltd., Ludgate Hill, Birmingham.—Revised price list of electrical wiring materials and accessories.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—Leaflet No. B.C. 3567, illustrating and describing a new grip spade terminal. Also Leaflet O.S. 3,616, dealing with motor omnibus lamps, and Leaflet O.S. 3,617, advertising a steel storage bin for automobile lamps.

Messrs. Robert Hornby & Co., Ltd., 7, Carlisle Street, Dean Street, W.1.—A price list of electrical wiring materials and accessories, electricity meters, &c.

Messrs. Herbert Morris, Ltd., Loughborough.—An illustrated catalogue of light electric overhead cranes.

Messrs. Higgs Bros., Witton, Birmingham.—Stock and price lists of motors and dynamos.

Messrs. C. A. Vandervell & Co., Ltd., Warple Way, Acton, W.3.—An illustrated and priced leaflet advertising l.f. transformers.

The Sun Electrical Co., Ltd., 118-120, Charing Cross Road, W.C.2.—An illustrated and priced folder advertising "Ediswan" headphones and "Televox" and "Dulcivox" loud speakers.

Radio Communication Co., Ltd., 34-35, Norfolk Street, Strand, W.C.2.—An illustrated and priced leaflet describing the "Polar" bobbin rheostat.

The Consolidated Pneumatic Tool Co., Ltd., Egyptian House, 170, Piccadilly, W.1.—A brochure advertising "Boyer" pneumatic tools for road construction, &c.

Messrs. L. G. Hawkins & Co., Ltd., 30-35, Drury Lane, Kingsway, W.C.2.—A leaflet containing illustrations of "Miller" lighting brackets.

Messrs. Siemens Bros. & Co., Ltd., Woolwich, S.E.18.—Pamphlet 720A, describing and illustrating the company's mine shaft signalling apparatus.

Messrs. Donovan & Co., 47, Cornwall Street, Birmingham.—An illustrated and priced leaflet dealing with mining type rotary switches.

The Siemens & English Electric Lamp Co., Ltd., 38-39, Upper Thames Street, E.C.4.—Catalogue No. 75, containing numerous illustrations of decorative glassware, silk shades, and metal fittings for lighting purposes. Priced.

Electrical Contracts & Maintenance Co. (1925), Ltd., Sanctuary House, Tothill Street, S.W.1.—A pamphlet advertising the company's maintenance service.

The Brush Electrical Engineering Co., Ltd., Falcon Works, Loughborough.—Publication No. 3,011, describing some petrol and trolley 'buses (bodies), made by the company during 1924.

Messrs. Graziani & Co., Ltd., 110, Fenchurch Street, E.C.3.—An illustrated brochure dealing with the products of the firm's principals, the "Ansaldo" Società Anonima, Genoa.

British Timken, Ltd., Common Lane, Ward End, Birmingham.—Two illustrated booklets dealing with "Timken" tapered roller bearings.

Howden Ljungstrom Preheaters (Land), Ltd., 133, Helen Street, Govan, Glasgow.—A leaflet reproducing charts of results taken by the boiler-house staff of a large power station, showing the improvement effected by the firm's preheaters.

Messrs. Carter & Mitchell, Ltd., 24, Allsop Street, Upper Baker Street, N.W.1.—Two illustrated pamphlets dealing with "Gardy" rotary snap switches and fuses.

Aluminium Production in Norway.—According to statements made in the German newspapers, Norway now occupies the second position in the world as an aluminium producer, the United States being first. As compared with only 6,000 tons in 1913, the manufacture of aluminium in Norway last year is stated to have amounted to 22,000 tons and to have thus surpassed that of Germany, Switzerland, and France. The Norwegian Nitrit Co. recently increased its share capital from 5,000,000 to 15,000,000 kr., and proposes to raise its last year's record production of 12,000 tons of aluminium to 15,000 tons this year. The Norwegian Aluminium Co. turned out 7,000 tons last year and will presumably be able to increase this quantity in the current year by the utilisation of the water powers in the north. The value of the Norwegian exports of aluminium in 1924 amounted to 62,000,000 kr., as compared with 33,600,000 kr. in the previous year.

Chinese Notes.—The *Chinese Economic Bulletin* states that Szechwan capitalists propose to form a company to harness the waterfall at Peituting, Liangshan, which is estimated to be capable of producing over 1,000 h.p. This will be sufficient to meet the lighting and small power requirements of a number of districts in the neighbourhood.

The Peking Telephone Administration is making preparations for the establishment of a North Branch exchange inside Teh Sheng Men (Peking).

The China General Omnibus Co., which is already running a fleet of 30 Tilling-Stevens petrol-electric motor omnibuses in Shanghai, has placed an order for a further twenty vehicles with Messrs. Tilling-Stevens, Ltd.

British Trade-mark Applications.—The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be lodged within one month from March 18th :—

Vermilor. No. 455,787. Class 8. Radio-telephonic apparatus.—Condensers, Ltd., All Saints, Manchester.

A. J. S. (lettering and design). No. 453,819. Receiving apparatus for use in radio telephony.—A. J. Stevens & Co. (1914), Ltd., Wolverhampton.

M. V. Shortpath (lettering and three designs). No. 454,735. All goods in Class 8.—Metropolitan-Vickers Electrical Co., Ltd.

Rusco. No. 456,301. Class 8. Instruments and apparatus for use in radio-telegraphy and telephony.—Runwell Cycle Co. (London), Ltd.

Crysteel. No. 455,684. All goods in Class 41.—The Benjamin Electric, Ltd.

National Trades Exhibition, Birmingham.—At the National Trades Exhibition, Bingley Hall, Birmingham, which was opened on March 16th for a period of two months, the Birmingham Electric Supply Department has an exhibit which represents several rooms of a house, and the use of electricity for all purposes is admirably demonstrated. There are displayed in excellent variety "Hotpoint" equipment, the "Jackson" cooker, the "Blighty" electric wash boiler, "Western Electric" washing machines, "Premier" electric fires and pedestal heaters, &c.

Electrolytic Copper Production in the Belgian Congo.—At the annual meeting of the Société de l'Union Minière du Haute Katanga, recently held in Brussels, it was reported that considerable attention was being devoted to the electrolytic treatment of low-content copper ores from the company's mines in the Belgian Congo. The results obtained at the experimental station, which has a monthly capacity of 100 tons, had encouraged the directors to proceed with the installation of a first plant for the treatment of ore capable of producing about 30,000 tons per year. Two further units each of the same capacity will be installed at a later date. The plants will be operated by power supplied by a hydro-electric station which is to be erected by an associated concern, the Société Filiale Hydro-Electrique, utilising the power of the River Lufira. In order to meet the ever-growing demand for refined copper, the Haute Katanga Co. has also decided to establish, in conjunction with the Société Générale Métallurgique de Hoboken, an electrolytic refinery capable of dealing with about 30,000 tons per year.

Projected Transport Exhibition at Cologne.—It has been decided to hold at Cologne in 1927 a great international transport exhibition comprising four main sections. The first of these will cover land-borne traffic, including railways, tramways, and traffic control systems. The second will represent water-borne transport, both oceanic and inland, and the third aerial transport. The fourth section will be devoted to postal, telegraphic, telephonic, and radio communications.—*Reuter* (Cologne).

Engineering Employés' Wages.—A meeting of representatives of the forty engineering trade unions concerned in the recent negotiations for an advance of £1 per week in wages was to be held in London yesterday. At this meeting a decision was to be arrived at regarding the next step to be taken in view of the deadlock which was reached at the conference with the employers at the beginning of March.

Metropolitan-Vickers Works for Australia.—Sir Vincent Raven, one of the English experts who reported recently on the New South Wales railways, informed the Lidcombe (Sydney) Council that the Metropolitan-Vickers Electrical Co., Ltd., of Manchester and Sheffield, of which he is a shareholder, had obtained a large contract connected with the electrification of the railway system in Sydney, and the company had decided to erect permanent works at Lidcombe for the manufacture of electrical equipment. He had formed the opinion that Australia was going to progress rapidly and that the electrical industry would make great strides. He considered that English manufacturers should assist the Dominions. His company had decided to spend a large sum of money on the works at Lidcombe.—*Industrial Australian and Mining Standard.*

The Safeguarding of Industries.—The National Union of Manufacturers and other bodies went before the President of the Board of Trade last week to make representations regarding the considerations which should weigh with him in deciding upon the period for which duties would be imposed under the Government proposals to safeguard threatened industries; also regarding the manner of deciding whether or not an industry was efficient; and respecting the effect of burden of taxation in this and other countries upon the question of the fairness or unfairness of competition. In reply, Sir P. Cunliffe-Lister said that the industries must have all their evidence prepared beforehand so as to avoid delays while committees were sitting. The committees would have to consider the question of efficiency, but they should not hear evidence in public if such a course might be detrimental to the interests of an industry or to those of an individual manufacturer. Mr. G. Terrell, in introducing the deputation, had stated that strenuous opposition to the imposition of duties was being organised by the importers here as well as by foreign exporters.

New French Companies.—Among the new companies recently formed in France are the Société La Soudure Electrique, 40 Boulevard Auguste Blanqui, Paris, with a capital of 500,000 fr., to manufacture electric welding plant; and La Société Les Fils Speciaux N.S., 59 Rue de l'Elysée, Tours, to manufacture electric wire, both bare and enamelled.

Book Notices. — "Industrial Electricity—Direct-Current Machines," by W. H. Timbie. Pp. xiii + 735; figs. 469. Price 17s. 6d. net. "Answers to Problems in Industrial Electricity," by W. H. Timbie. 15 pp. Price 2s. 6d. net. "Principles and Applications of Electrochemistry," by H. J. Creighton. Vol. I, Principles. Pp. ix + 446; figs. 76. Price 20s. net. "Elements of Electrical Engineering," by A. L. Cook. Pp. viii + 568; figs. 365. Price 20s. net. London: Chapman & Hall, Ltd.

"Transactions of the First World Power Conference," in four volumes. Pp. 6,500; fully illustrated. London: Percy Lund, Humphries & Co., Ltd. Price £12 net.—An index volume of 600 pages, containing 40,000 references, is in preparation, price £2 net.

The *Decimal Educator* for March contains articles showing metric progress throughout the world, a *résumé* of a statement presented to the Committee on Industry and Trade, and a copy of a letter recently sent to all members of Parliament.

S.F. Pamphlet No. 2. Issued by the Mines Department. Pp. 15. London: H.M. Stationery Office. Price 1d. net.—The pamphlet is the second issue of its kind and contains some 50 descriptions of recent fatalities reported to the Mines Department, which by the exercise of a little more care and forethought could have been prevented.

Employment During February.—The March issue of the *Ministry of Labour Gazette* states that employment in the engineering industry during February remained bad on the whole, but showed a slight improvement in most districts as compared with the previous month. It was still very bad in marine engineering, but fairly good in electrical engineering, and fair at railway, motor and cycle works. The position as compared with that of a year ago was improved in nearly all districts. The detailed statistics for the month showed that the percentage of unemployed in the electrical engineering industry was 5.5, a decrease of 0.1 per cent. as compared with January. In "electrical wiring and contracting" and "in electric cable, wire, and electric lamp manufacture" there was an increase of 0.2 per cent.

Westinghouse U.S.A. Contract.—The *Electrical World* states that the Westinghouse Electric and Manufacturing Co. has received a contract from the West Penn Power Co., Pittsburgh, amounting to nearly $1,000,000, for power equipment. The order covers one 60,000-h.p. turbo-generator, with a 62,500-sq. ft. condenser. The unit is being built at the South Philadelphia works of the Westinghouse Co. and will be installed at the Springdale power house of the West Penn Co.

French Foreign Electrical Trade.—*Commerce Reports* publishes a list of French imports and exports during 1924, based upon a report from the U.S. Commercial Attaché at Paris. This shows that the exports of dynamo-electric machinery increased by 44 per cent. to 4,081 metric tons, while exported electrical apparatus amounted to 5,446 metric tons, an increase of 61 per cent. On the other hand, electrical imports were lower. Dynamo-electric machinery is put at 2,684 tons (34 per cent. decrease), and electrical apparatus at 1,519 tons (1 per cent. decrease).

Co-partnership in New Zealand.—Details of an Act recently passed by the New Zealand legislature to enable companies to create and issue to their employés a special class of "labour shares" appear in the March *Ministry of Labour Gazette*. These shares will have no nominal value and will not form any part of the capital of a company, but they will entitle the holders to attend and vote at meetings of shareholders, and to share in the profits of a company, or its assets in the event of its being wound up.

Electrical Undertakings and the King's Roll.—*The Times* states that since the private Bill promoted by the County of London Electric Supply Company was rejected because it was not on the King's Roll for the employment of disabled ex-Service men, that company and eight other large electrical undertakings have been registered by the King's Roll National Committee.

Proposed New Swiss Tariff. — Accompanying the *Board of Trade Journal* for March 19th, was a complete translation of the new general customs tariff which the Swiss Government proposes to adopt. Copies of this may be obtained by others than regular subscribers to the *Journal* at the cost of 6d.

"English Electric" Goods-Handling Locomotives.—Four electric locomotives have lately been supplied by the ENGLISH ELECTRIC CO., LTD., to the Harbour Commission of Montreal to handle dockside traffic. Each locomotive is equipped with four 430-V d.c. with electric camshaft control, operating on a 2,400-V d.c. supply from the overhead line. Double driving positions are provided at one end to facilitate shunting operations. The locomotives, which are capable of hauling trains up to 3,300 tons weight, weigh approximately 90 tons each.

New Belgian Company. — A new company has recently been formed in Brussels with a capital of 6 million francs and the title La Société d'Electricité de la Basse-Meuse, to undertake the supply of electricity in the lower Meuse area.

Swiss Electrical Machinery Exports. — During last year the value of the electrical machinery exported from Switzerland was 24,159,000 fr., as compared with 22,548,000 fr. in 1923.

Prices of Raw Material.—MESSRS. LINDSAY & WILLIAMS, LTD., of Bennett Street Works, Ardwick, Manchester, have again issued their wall chart showing fluctuations in prices of raw materials for cable manufacture during the year 1924.

New Municipal Showrooms and Offices.—Swansea Town Council has agreed to the Electricity Committee taking a 21 years' lease of the Carlton Restaurant premises in Oxford Street at a rental ranging from £600 to £1,000 per annum. The premises are required for use as offices and a showroom.

The National Register of Contractors.—The annual general meeting of the National Register of Electrical Installation Contractors is to be held to-day (Friday), at the offices of the I.E.E., Victoria Embankment, W.C.2, at 2.30 p.m. The agenda includes the amendment of the standing order relating to the appointment of the executive committee; the consideration of the appointment of a treasurer; the election of the chairman and the vice-chairman for the current year; and consideration of the question of inviting registered contractors who are not members of any electrical trade organisation to appoint representatives on the Registration Board. The balance sheet which is to be presented shows a healthy financial position.

Lead.—In their report dated March 21st, Messrs. James Forster & Co. stated that the price of the metal was still high, and only a sustained buying movement on the part of the consumers here and on the Continent would keep prices at the present level.

Callender Broadcasters.—The Callender's Cable Works band, which so successfully broadcast from 2LO recently, is to give a further similar performance on Saturday, April 5th, a signal mark of appreciation from Mr. Dan Godfrey, Junr.

Removal of New Zealand "Dumping" Duties.—The *Board of Trade Journal* states that the New Zealand Government has decided to remove Depreciated Currency Duties on goods from all countries as from April 9th.

Manchester Contract for the United States.—In December last, as reported in the Electrical Review at the time, the Manchester City Council rejected a recommendation by the Tramways Committee to place an order for special tramway track-work with the United States Steel Products Co. The matter was thereupon reconsidered by the Committee, which recommended the division of the contract into four parts, three of which would go to British firms and the fourth to the American company. This recommendation came before the Council last week, and a Labour amendment to refer the matter back to Committee was defeated, and the proposal carried. The Labour objection to the placing of a part of the contract with the United States Steel Products Co. was based on the allegation that the men employed by the firm were non-unionists and worked 12 hours a day for seven days a week.

Works Closing.—The *Financial Times* reports that Messrs. Richardsons, Westgarth & Co.'s large marine engineering establishments at West Hartlepool and Middlesbrough are to shut down within a month. Another contemporary says that the Middlesbrough staff has received a month's notice.

The Nation's Food Exhibition.—This exhibition, which is to be held at Olympia, W., from April 11th to May 2nd, is not confined to British food production and preparation alone; a number of foreign governments have been allotted space. The *pièce de résistance* of the show will be a model farm, but from the electrical point of view interest will centre chiefly on the cookery and refrigeration exhibits.

Swedish Lock-out.—A *Reuter's Trade Service* message states that a lock-out affecting 130,000 workers in the engineering, shipbuilding and other Swedish industries commenced on March 16th. There were threats of retaliation by means of a general strike from some of the men's trade unions.

Fire.—On March 18th, an outbreak of fire occurred at the premises of the Dictograph Telephone Co., Denman Street, London Bridge.

Unemployment.—A reduction of 14,900 occurred in the total number of unemployed during the week ended March 9th, the figure at that date being 1,220,700.

Copper and Lead Prices.—Messrs. F. Smith & Co. report, March 24th: Copper (electrolytic) bars, £68 5s., 10s. dec.; ditto ditto sheets, no change; ditto ditto wire rods, £78 5s., 10s. dec.; ditto ditto h.c. wire, 9 13/16d., 1/16d. dec.

Messrs. James & Shakespeare report, March 24th: Copper bars (best selected), sheet and rod, £94, £1 dec.; English pig lead, £38, 15s. dec.

Lighting and Power Notes.

Brixham (Devon).—Electricity Supply.—The annual report of the Brixham (Devon) Gas Co. shows a profit on the electricity account for the past year of £302, and the company has given notice of a reduction in the price of electricity from 1s. 1d. to 1s. per kWh.

Continental.—Germany.—A project for utilising the power of the Lahn River is about to be realised. A company consisting of representatives of towns and districts of the Rhine Province has been formed to carry out the enterprise. A hydro-electric works near Kramberg, which it is estimated will generate annually 12,000,000 kWh, will be first constructed and, later, dams will be constructed near Dausenau, Nassau, and Nievern.—*Commerce Reports.*

Although there was a falling-off in the consumption of electricity in Berlin in 1923, the past year has witnessed a marked development in the demand, which is now 50 per cent. greater than in 192. The present municipal power stations in the German capital have a total capacity of 200,000 kW, and it is considered that, to meet the growing demand, this must be doubled by the winter of 1927-28 at the latest. It is proposed to establish two new generating stations, one near Lake Rummelsberg and one on the Upper Havel in the north of the city, both being planned for an eventual capacity of 400,000 kW. The scheme also provides for the construction of five new transformer stations. When the new plants are completed, the existing Rummelsberg, Mcabit, and Charlottenburg stations, each of 70,000-kW capacity, will be used as reserves.

A statement has recently been placed before the Budget Committee of the Bavarian Diet by a representative of the Government with regard to the development of the water-power in the State. Out of the total of 2,000,000 h.p. capable of being utilised, 540,000 h.p. or 27 per cent., has been brought into use, while 145 installations, representing 400,000 h.p., are in course of preparation, and works for 50,000 h.p. are under construction, so that practically one half of the total power available is being developed. An economic plan has been set up for the distribution of the energy. The Bayernwerk already supplies energy as far as Stuttgart by way of the Wurtemberg Electricity Co., and a similar agreement has been made with the electricity works at Hochst-on-Main.

Switzerland.—From Berne it is announced that the Bernische Kraftwerke Gesellschaft and the authorities of the Canton of Berne are participating in the financing of a new company entitled the Oberhasli Kraftwerke Gesellschaft, to establish a number of hydro-electric stations which, when completed, will have an annual capacity of 537 million kWh. The scheme provides for the utilisation of the power of the River Aare in three stages between the summit of the Grimsel and Innertkirchen, where there is a net fall of 3,968 ft. It is proposed to start work only on the Handeck power station, in connection with which Lakes Grimsel and Gelmer would be used for storage reservoirs. The dam to be constructed will be 328 ft. high. The cost of the first station is estimated at about £3,330,000. The energy generated will be taken by the Bernische Power Co., the output of whose existing stations is stated to be from 60 to 80 million kWh below the existing demand to-day, which deficiency is estimated to reach 237 million kWh by 1932.

Dewsbury.—Loan.—The Town Council has applied to the Electricity Commissioners for sanction to a loan of £7,500 for mains.

Glasgow.—Proposed Change-over.—The Corporation has applied to the Electricity Commissioners for sanction to change over its system of electricity supply from d.c. 3-wire at 250 and 500 V to a.c. 4-wire, 25 cycles, at 250 and 440 V.

Destructor Works Plant.—In connection with the scheme for installing plant at the destructor works, the Corporation has received a communication from the Electricity Commissioners advising the installation of 50-cycle plant, and the Cleansing Committee has recommended that this type of plant be installed with the necessary frequency changers to reduce the frequency to 25 cycles. The Committee has also recommended that the frequency changers be installed and fitted up through the Electricity Department.

"All-Electric" Houses.—Sir John Gilmour, Bt., M.P., Secretary for Scotland, on March 13th declared open an "all-electric" housing scheme for the Corporation. Electric cookers, washers, and radiators are installed.

Hamilton.—Termination of Agreement.—The Town Council has decided to give notice to Messrs. Edmundson's Electricity Corporation, Ltd., that the Council is to exercise its option in terms of the agreement of 1910 to terminate the principal agreement with the company as at May 29th, 1926.

Inquiry.—Colonel T. C. Ekin, M.Inst.C.E., is to hold an inquiry at the Town House, Hamilton, on March 31st, at 10.30 a.m., concerning the application by the Town Council to extend its generating station.

Haswell (Co. Durham).—Electricity Supply.—Electricity for street lighting has been introduced in the district and a supply is also now available for private consumers. The energy is supplied by the Houghton-le-Spring and District Electric Lighting Co., which is a subsidiary company to the Newcastle Electric Supply Co. Messrs. Reid, Ferens & Co., Ltd., of Newcastle, were the contractors for the equipment for street lighting, for which the local Council raised a loan of £2,000.

Japan.—Kobe.—*Finance and Commerce* states that a scheme for doubling Kobe's electricity supply has been drawn up by the Municipal Electric Bureau in view of the rapid increase of the population. The present maximum capacity is 25,000 kW. The cost of doubling this is estimated at from 8,000,000 to 10,000,000 yen. In case of emergency the city has the right to draw on the supplies of two Osaka companies. The current available from these is also to be increased to 50,000 kW if the Bureau's scheme is adopted.—*Reuter's Trade Service* (Shanghai).

Lanark.—Electricity Scheme.—Messrs. Strain & Robertson, engineers, have notified the Town Council that the Clyde Valley Electrical Power Company is to lay cables through roads and streets. There will be two main cables for the transmission of a.c. 3-phase at a pressure of 11,000 V and one or more

small cables for subsidiary purposes in connection therewith and one main cable for the distribution of a.c. 3-phase at a pressure of 400 V.

London.—SHOREDITCH.—The Electricity Committee has recommended to the Borough Council that application be made for sanction to loans of £6,000 for services and meters, and £3,826 for mains.

EXPLOSIONS.—A series of explosions occurred in the main thoroughfare at Notting Hill Gate on March 19th, due, it is stated, to the fusing of an electric cable. A number of persons received minor injuries.

Millom.—ELECTRICITY SCHEME.—The Urban District Council is applying to the Electricity Commissioners for sanction to a scheme to obtain a supply of electricity from the Millom and Askam Hematite Iron Co., Ltd., at a flat rate of 1d. per kWh and a standing annual charge of £240 for a period of 25 years, instead of £315 as originally proposed. The Council is also to seek powers to distribute electricity throughout the district.

North Berwick.—PURCHASE OF UNDERTAKING.—The North Berwick and District Electric Light & Power Co., Ltd., has accepted the offer of £10,500 by the Town Council for the purchase of its undertaking, on condition that the Council pays an additional £250 towards the cost of a Special Order. At a recent meeting of the Council it was agreed to pay the additional amount.

Paignton.—PROPOSED PURCHASE OF UNDERTAKING.—At a meeting of the Urban District Council, a letter was read from the Paignton Electric Light & Power Co., Ltd., stating that the company was not prepared to enter into negotiations with the Council for the sale of its undertaking. The Town Clerk has, however, been instructed to take the necessary steps with a view to the purchase of the undertaking by the Council.

Pontardawe (Swansea Valley).—PURCHASE OF UNDERTAKING.—Terms of an agreement to purchase from Messrs. W. Gilbertson & Co. the whole of the company's street and public lighting electrical plant for £7,000 have been approved by the Rural District Council.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

SWINDON.—Lighting: From 6d. to 5d. per kWh. Heating: From 1½d. to 1¼d. per kWh. Power: From 3d. to 2½d. per kWh. Traction: From 1.7d. to 1.4d. per kWh.

DONCASTER.—Lighting: From 6d. to 5½d. per kWh. Signs and shop window lighting: From 3d. to 2½d. per kWh. Theatres and kinemas: From 3½d. to 3d. per kWh. High-pressure supplies for power, present charges, less 5 per cent., with cash discount of 5 per cent.

MEXBOROUGH.—Heating: First 100 kWh per quarter, 1½d. per kWh, all energy in excess of this amount, 1d. per kWh.

NORWICH.—Assessment rate: From 14 per cent. on the assessment to 12½ per cent. The fixed charge for business premises from £15 for the first kW and £10 per kW for the remainder to £13 10s. and £9 respectively. To consumers not subject to a fixed charge, from 6½d. to 6d. per kWh.

BINGLEY.—The charge for heating, cooking and domestic power to be reduced to 1½d. per kWh from July 1st next in cases where the consumer also takes energy for lighting purposes up to a guaranteed minimum.

Ramsey (I. of M.).—ELECTRICITY SUPPLY.—The Town Commissioners on March 10th considered a recommendation that the application of the Ramsey Gas Light Co., Ltd., for powers to supply electricity in the town should be opposed. An amendment that a special meeting should be held to discuss the question of an electricity supply was carried.

South Africa.—CAPE TOWN.—Application has been made to the Electricity Control Board by the Electricity Supply Commission for a licence to establish an electricity undertaking in the Cape Town district. The area of supply for which powers are being sought includes the area of the Railways and Harbours Administration with a radius of 110 miles from the generating station. It is also proposed to supply electricity to Cape Town Corporation and to Milnerton Estates, Ltd., for railway traction purposes only. The station will have an initial capacity of 30,000 kW and will be erected on a site on the north side of the Estuary of the Salt River. The Corporation Electricity Committee has decided to make no objection to the proposal. An inquiry into the application is to be held by the Electricity Control Board at Johannesburg on April 6th.

Southend.—LOAN.—The Electricity Committee has recommended to the Town Council that application be made for sanction to the borrowing of £40,000 to cover the cost of purchasing two Diesel engines, two 750-kW d.c. generators, and one 750-kW flywheel alternator, together with the necessary plant, foundations, &c.

Special Orders. — The Electricity Commissioners have submitted the following Special Orders to the Minister of Transport for confirmation:—Lichfield Electricity Special Order, 1925, for the supply by the City Council in the city and rural district; Portsmouth Electricity (Extension) Special Order, 1925, for the supply by the Corporation in the rural districts of Catherington and Fareham, and part of the rural district of Westbourne; York Town and Blackwater (Wokingham Extension) Special Order, 1925, for the supply by the York Town and Blackwater Gas Co., of electricity in the borough of Wokingham.

Application has been made by the Isle of Wight Electric Light & Power Co., Ltd., for a Special Order to supply in the whole of the rural district of the Isle of Wight, excepting the parishes of Northwood, Carisbrooke and Bonchurch.

Windsor.—STREET LIGHTING.—The Town Council has accepted the offer of the Windsor Electrical Installation Co. for public lighting for one year at £375.

York.—PROPOSED NEW PLANT.—The estimated expenditure on new plant for the forthcoming year is as follows:—Turbo-generator, £26,000; boilers, £18,000; motor generators, £9,500; cables and services, £25,000; additional boilers, £20,500.

Tramway and Railway Notes.

Bury.—LOAN.—The Town Council is applying to the Ministry of Transport for sanction to a loan of £25,000 for the purchase of six new tramcars of the totally enclosed type, and the conversion of six cars to the totally enclosed type.

Continental.—SWITZERLAND.—The Compagnie du Chemin de Fer des Alpes Bernoises has ordered two new single-phase electric locomotives of 4,200 h.p. These locomotives are to run on the Frutigen-Kandersteg trunk line section.

Under the terms of a contract between the Bundner Kraftwerke Gesellschaft, of Basle, and the Swiss Federal railway authorities, the company undertakes to supply, as from June 1st, 1927, three million kWh per year for the operation of the electrified Swiss Federal railways. The quantity is later to be increased to an annual total of 25 million kWh and eventually to 45 million kWh.

FRANCE.—The line from Culoz to Modane, 134 km. in length, will be the first main line to be electrified by the Paris, Lyons, Mediterranean Co. It forms a section of the international line from Paris to Turin, Milan, Genoa, and Rome, the Italian section having been converted 10 years ago. Three-phase current at 15,000 V, 16⅔ cycles, is employed on the Italian portion. On the French section of the line continuous current at 1,500 V will be used. The electrification is expected to be completed within two years.

The French Senate has authorised the city of Paris to contract a loan for the completion of the complementary network of the Metropolitan railway, but has reduced the amount of the expenditure from 620 million fr. to 500 millions. As the city owes 140 millions to the railway company, the actual amount of the outlay will be 360 millions, of which some 80 millions will be required for the proposed double tunnelling under the Seine.

ITALY.—By a recent decree the sum set apart in the financiay year 1924-25 for subsidies in aid of the construction of railways is raised from 8 to 10 million lire.

Wherever traffic is heavy and grades are sufficiently long to cause wasteful coal consumption under present steam operation, the Italian State Railway authorities have decided to electrify their lines, notwithstanding the heavy expenditure involved. How greatly the cost of construction has advanced within the past 12 years may be gauged from the fact that whereas, in 1913, it was found practicable to electrify at 100,000 lire a km., and coal was 30 lire a ton, to-day the estimated average cost for similar work is 550,000 lire a km., while coal costs 212 lire a ton (36s. at current exchange).

The actual length of line under process of electrification to-day is 591 km., and the total cost of this is estimated at 394,850,000 lire. The Government has authorised—but the State Railway directors have not yet approved—a further 1,903 km. of electrified line to cost 181,964,000 lire, or a total cost of 1,324,850,000 lire for the electrification of 2,494 km., which gives an average cost of 530,000 lire per km., excluding the cost of electric locomotives.

In addition to the above enterprise, the Italian State Railways will shortly call for bids from private contractors for the electrification of the four following lines:—Usmate-Calolzio-Bergamo (45 km.); Milan-Bologna (216 km.); Pisa-Florence; Viareggio-Pistoia; Pisa-Lucca-Castelnuovo Garfagnana (135 km.); Bologna-Padua-Mestre Portogruaro-Monfalcone-Trieste, and subsidiary lines (274 km.). For this length of 670 km. the estimated cost is 359,000,000 lire, the funds for which it is hoped to save from a decreased purchase of foreign coal, representing an economy of 24.52 per cent. upon the Government's annual coal requirements, which now exceed 2,600,000 tons.

Irish Free State.—DUBLIN AND LUCAN ELECTRIC TRAMWAY.—The residents of Lucan have appealed to the local authorities in Dublin and the outlying townships to grant an extension of lease to the Dublin United (Electric) Tramways Co., so as to facilitate the taking over of the Dublin and Lucan electric tramway. The Lucan service ran to within a few yards of the Dublin city tramway, and it is proposed that the lines should be connected up at Phœnix Park main gate in order to provide through running between Lucan and O'Connell Bridge, Dublin.

Japan.—KOBE.—Efforts are being made to obtain support to a proposal to construct an underground electric railway in the town instead of an elevated line.

FORMOSA.—The Settsu Electric Motor Car Co., of the Hanshin Tramway Co.'s group, has obtained permission from the

competent authorities to lay a tramway track from the Hanshin's Koroen Stop to Kurakuen Park, Rokko, a distance of over two miles. The construction of the line is to be started at once.—*Eastern Engineering.*

Failsworth.—Lease of Tramway.—The Urban District Council has given notice of its intention to grant a lease to Manchester Corporation of the tramway in Oldham Road. The term of the lease will be 21 years, commencing April 1st.

Keighley.—Railless Traction.—Mr. C. Jackson, tramway manager to the Corporation, lectured to the Keighley Association of Engineers last week on the railless trolley vehicle services. The Keighley system, Mr. Jackson pointed out, was the first complete system in the country to be so converted, and it was decided upon because of the comparatively low cost of operation, the high acceleration obtainable, and the high average speed. From tests taken, the maximum acceleration worked out at 1.15 miles per hour per second, giving a rise in speed to 13 miles per hour in eleven seconds. The maximum speed on the level was 21 miles per hour for a double-decked car and 20 miles per hour for the single-decker.

London.—New "Underground" Sub-station Equipment.—To facilitate the operation of increased train services it has become necessary to add to and re-arrange the equipment of certain sub-stations that are at present liable to overload, or will be in the near future. At Victoria a new 2,000-kW rotary converter will replace one of the existing 1,200-kW machines, which will be transferred to Russell Square. A new 1,500-kW rotary will be installed at Baker Street, this addition necessitating an enlargement of the sub-station building; and the Bond Street equipment will be augmented by the transfer of a 900-kW rotary from Wood Lane. At Lots Road 10 h.p. "group" switches controlling the supply to the sub-stations are to be replaced by switches of modern type. To augment the supply of air for signalling purposes 12 new compressors are to be installed—two on the District railway (at Ravenscourt Park sub-station), five on the London Electric Railway (two at Russell Square, two at Kentish Town, and one at Baker Street), and five on the Central London railway (two at Notting Hill Gate, two at Bond Street, and one at Shepherd's Bush).

New Sidings at Edgware.—The projection of the Hampstead railway to Edgware has made it necessary to provide terminal accommodation in the form of eight sidings, each 400 ft. long, in addition to the two platform roads which are also used for "stabling" trains during slack periods and at night; the total length of sidings is now 3,831 ft., which provides "stabling" accommodation for 76 cars. The sidings are provided with current rails throughout, are track circuited and signalled, and are under the entire control of the passenger station signalman; thus, the usual manual shunting operations are eliminated. Four of the sidings are under cover and provided with specially designed inspection pits which have a double ledge on each side, on which the carriage repairer may stand. The car shed is also equipped with an overhead trolley cable, which enables the rolling stock to be moved over the inspection pits, gives freedom of movement to the inspecting and examining staff, and obviates the use of shunting locomotives.

L.C.C. Tramways.—The Treasury has approved the London County Council's proposal to suspend sinking fund payments for a period of three years (*vide* Elec. Rev., February 12th, p. 276) on condition that the cost of maintenance, repairs, &c., is adequately defrayed out of revenue.

Reading.—Track Renewals.—The Corporation proposes to re-lay portions of its tramway track and application has been made to the Minister of Transport for sanction to the borrowing of £12,037 to cover the cost of the work.

Rothesay.—Proposed Purchase of Undertaking.—The Town Council has decided to open negotiations with the Rothesay Tramways Co. with a view to purchasing the company's undertaking.

Southend.—Loan.—The Town Council is applying to the Ministry of Transport for sanction to a loan of £40,950, to cover the cost of permanent-way repairs, cables, and the provision of top covers on 11 tramcars.

Telegraph and Telephone Notes.

Cable Ships' Refits.—The cable-laying ship *Monarch*, employed under the Postmaster-General's Department, has been sent to Sheerness Dockyard for refit, the cost of which will be charged to the Department, says the *Morning Post*. The cable-laying ship *Alert* recently resumed duties after refitting at Sheerness.

France.—Long-distance Telephony.—As a part of the proposed long-distance telephone network advocated by the French Ministry of Posts and Telegraphs, it is reported that the French and Swedish Telegraph Administrations are planning a direct telephone circuit between Stockholm and Paris and, according to *Commerce Reports*, it is hoped that it will be in operation before the end of 1925.

Guernsey.—Telephone Statistics.—The revenue statement and statistics of the State telephone department (of which Mr. E. H. Bennett is the engineer and manager) show that during the year ended December 31st, 1924, a net profit of £320, a decrease of £110, was realised. The revenue increased by £986 to £15,893, the number of subscribers' lines increased by 208 to 2,925, and the public telephones increased by 6 to 68, but the private lines decreased by 1 to 18. The underground cables increased by 4 to 56, and underground distributors by 10 to 107 in number. The mileage of overhead lines increased by 92¼ to 2,323 miles, and that of underground lines by 453¼ miles to 3,149¼.

Portugal.—New Marconi Co.—The Finance Commission of the Chamber has approved the alterations which the Government intends to make in the contract with the Marconi Wireless Telegraph Co. requiring the company to incorporate a subsidiary company in Lisbon with a capital of £300,000.—*Reuter* (Lisbon).

South Africa.—Automatic Telephony.—The Cape Town City Council has had a joint report from the heads of departments with regard to the installation of an automatic telephone exchange to replace the present system, together with a copy of a communication from the Surveyor of Posts and Telegraphs, Western District, detailing three courses open to the Council in this connection and the relative annual cost of each proposal. The chief officers recommend the acceptance of the offer of the postal authorities, the choice of the system to be left to the postal authorities on the understanding that the annual charges for the system chosen will not exceed those quoted for the "Relay" system. The Sub-Committee recommends that the proposals of the chief officers be approved, but that no definite action be taken until further representations have been made to the Postmaster-General to regard the municipal telephone exchange as a branch exchange. Subject to this proviso, the Council is recommended to approve of the principle of installing a complete automatic telephone system during the current year.

Sumatra.—New Radio Stations.—Radio stations have been opened at Medan and Bengkalis, in northern Sumatra, operated by the Post and Telegraph Service of the Netherlands East Indies Government, and are being used for communication with ships and with each other. Previously there was only one radio station, at Sabang, on the island of Wo, but *Commerce Reports* says it is contemplated to add others to complete the interior system.

Turkey.—Proposed High-Power Radio Station.—According to a Constantinople correspondent of the *Chicago Tribune*, the Turkish Government has decided to build at Angora "the most powerful radio sending station in the world." The plans have been prepared by Capt. Edward Walker, who is stated to be acting on behalf of the Radio Corporation of America. British, French, and German companies are also said to have representatives in Constantinople in connection with the scheme. The Government has approved an outlay of £T2,500,000 on the project.

New Atlantic Cable.—Mr. W. Carlton, of the Western Union Telegraph Co., who came to England to complete negotiations for laying a new Atlantic cable, sailed from Southampton on March 21st. He said that an important alteration had been made in the scheme. It was originally intended that the cable should be laid in two sections, first between Penzance and Newfoundland, and later between Newfoundland and New York. Now, however, the cable would be completed, as one job, from Penzance to New York, *via* Newfoundland. It is understood that the Telegraph Construction and Maintenance Co. has been awarded the contract, and that the cable will be ready for laying in the summer of 1926. The American company, Mr. Carlton mentioned, has also signed a contract with a German cable company, by which the German cable to the Azores will be carried on to New York.—*The Times.*

Radio Notes.

Broadcasting Legislation.—The Wireless Bill.—On Friday last the Postmaster-General received a deputation from the Radio Association on the proposed wireless legislation. In replying to the various points raised, Sir William Mitchell-Thompson agreed that sympathetic consideration should be given to the Association's suggestion for a reduction of the penalties for listeners. The Association's Fellowship, acquired by examination, together with the degrees of other scientific bodies, would be taken into consideration when the grant of an experimenter's licence was under review. The subject of interference from power stations, &c., was also raised, and Sir William expressed the hope that the Post Office would be able to come to some satisfactory working arrangement with the authorities concerned. He said that the Post Office did not wish to treat the broadcast service as a substantial source of revenue to the State, and would give every consideration to the possibility of reducing the licence fee as the number of licences increased.

Broadcasting in India.—Bombay.—The Bombay Radio Club has completed its first year, and the annual general meeting was held in the last week of February. The results showed that the club had passed a very satisfactory year and that its future was assured. The membership was 306, and was expected to increase rapidly. The club was broadcasting programmes every day, the secretaries doing the work voluntarily.

CALCUTTA.—The Indian public has long been waiting for some definite pronouncement in connection with broadcasting, but the Government is still silent. Meanwhile it is learnt that the Calcutta Radio Club has decided to install its own transmitting set.

COLOMBO.—From an interview published in the *Times of Ceylon* with Mr. Wardrop, the representative of the Western Electric Co., it is understood that Colombo will have a high-power broadcasting station of about 2 kW, which will cover the whole of Ceylon. It has been decided to install the push-pull type of special microphone for transmission.

Broadcasting Plays.—Speaking at a luncheon in connection with the annual meeting of the Theatrical Managers' Association, Mr. Tom B. Davis, who presided, is reported to have said it was a pity that theatre managers could not agree among themselves on their attitude towards broadcasting. The B.B.C. had its programmes advertised in the Press free of charge. That was a great grievance, because the theatrical profession had to spend thousands a year in advertising their shows.

New Zealand. — NEWSPAPER INSTALLATIONS BANNED. — Government regulations prevent newspapers installing radio plant for the reception and publication of news.

International Broadcasting.—LONDON CONFERENCE.—As announced last week, the first international broadcasting conference held in Europe opened in London on March 18th. Between 30 and 40 representatives of broadcasting interests in nearly every European country were present at the invitation of the B.B.C. It was agreed in principle that an international bureau should be established, to act as a clearing house of information and an instrument of adjustment of general difficulties arising out of broadcasting. Sub-committees were appointed to discuss various problems, such as choice of wavelengths and power, particularly with regard to the possibility of interference.

Wireless Time Signals.—A DISCUSSION.—The British Horological Institute announces that a debate will be held at the Institute, 35, Northampton Square, London, on April 22nd, at 6.30 p.m., on the subject of wireless time signals, and the most desirable type of transmission code from the point of view of the watch, clock, and chronometer manufacturers in the British Isles. The Swiss Horologists recently considered the same subject and decided in favour of terminating each minute of the International ONOGO code with the six dot seconds as transmitted by the British Broadcasting Company from Greenwich, which has proved to be desirable.

It is stated that the Swiss Group has already approached the Bureau International de l'Heure, of Paris, with this request, but that organisation (commonly referred to as the B.I.H.), is merely an executive body under the International Astronomical Union, which has a special section responsible for the whole of the world's international wireless time-signals. Any such changes in transmitting codes can only emanate from the Astronomical Union, because it is an international body, and as a conference is to be held at Cambridge in July this year, it is considered desirable that the question of the most suitable forms of time signals for various purposes should be thoroughly thrashed out so that the Cambridge meeting may have all the evidence before it. The debate will be open to members of the Institute and others interested in this important subject.

Broadcasting in London.—NEW STATION OPERATING.—The historic London broadcasting station at Marconi House was closed down last week, and the new one with the same familiar call sign of 2LO undertook the regular transmission of the daily programmes of the British Broadcasting Co. During little more than three years the Marconi House station has achieved fame. Equipped for experimental use early in 1922, it was first used to broadcast on May 11th, 1922, and in November, 1922, the responsibility for programmes was assumed by the British Broadcasting Committee, which gave place to the British Broadcasting Co. in December. Since then 2 LO has been associated with many notable events, and during the three years of its existence it has been visited by more than three thousand members of the public.

After being out of action for about a week the Marconi House station resumed operations owing to adverse criticism of the new Oxford Street station. The B.B.C., by means of portable receivers, found an area over which reception was variable and unsatisfactory. The opinion was formed that "asymmetrical radiation" was taking place—reception was not equally good at equal distances in every direction. A shielded area was also discovered. Tests are being continued.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names of makers or suppliers of :—

Apparatus for felling trees by means of a wire electrically heated.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared in our advertisement pages.)*

Open.

Aberdeen.—April 29th. Electricity Department. Four water-tube boilers, with superheaters, economisers, draught fans, steel chimneys, piping, and accessories; also for dismantling and re-erection of certain existing boilers. (See this issue.)

Adwick-le-Street.—April 6th. Urban District Council. Sub-station equipment, h.p. and l.p. joint boxes and cables, distribution pillars, &c. (March 6th.)

Ashford.—March 30th. Electricity Department. Power house building and 10-ton hand-operated overhead travelling crane. (March 13th.)

April 6th. Transformers. (March 20th.)

Australia.—BRISBANE.—May 27th. Brisbane Tramway Trust. Tramway sub-station equipments, *viz.*, converters, transformers and switchgear for six stations. Specifications from the office of the Melbourne and Metropolitan Tramways Board, Melbourne.

SYDNEY.—May 12th. Postmaster-General's Department. Accumulator and counter e.m.f. cell batteries.*

Ayrshire.—March 30th. Education Authority. Electric lighting at St. Joseph's R.C. school, Kilmarnock. Schedules from Mr. W. Reid, master of works, Education Office, Ayr.

Bridlington. — March 30th. Electricity Department. Mechanical stokers, grates, forced-draught plant, coal elevators, hoppers, and superheaters for Lancashire boilers. (March 20th.)

Bristol.—April 16th. Electricity Department. One 7,000-kW turbo-alternator, with condensing plant and auxiliaries. (March 20th.)

Bury.—The Corporation Tramways Committee is inviting tenders for six new tramcars of the totally-enclosed type and for the conversion of six cars of the bogey type to the enclosed type.

Bradford.—Board of Guardians. Electric light installation, Homes for Aged Poor, Daisy Hill. Mr. F. Holland, engineer and architect, 22, Manor Row, Bradford.

Chile. — SANTIAGO.—May 14th. Inspeccion-General de Hidraulica. Four 3-ton electrically-operated cranes and one 20-ton ditto.*

Dartford.—April 6th. Electricity Department. Six or twelve months' supply of small steam coal. (See this issue.)

Dublin.—April 6th. Borough Commissioners. Electric wiring of 180 houses at Marino. Particulars (21s.) from the City Treasurer's Office, Lord Edward Street, Dublin.

Egypt.—CAIRO.—May 2nd. General Manager, Egyptian State Railways, Telegraphs and Telephones. 8,000 metres of submarine cable, 45 tons h.d. copper wire, &c., for telephones, 19,630 metres of cable. Inspecting Engineer in London.

April 4th. 1,900 electricity meters for various towns. Director of the Section of Municipalities and Local Commissions, Savoy House, Cairo.

Edinburgh.—April 10th. Electricity Supply Department. Steam, feed, and circulating pipework, with valves. (See this issue.)

Felixstowe.—April 4th. Urban District Council. Supply of motors, meters, switchboard; overhead construction. (See this issue.)

Gravesend.—April 20th. Electricity Department. 5,000-kW turbo-generator, condensing plant, switchgear, and straight-tube water-tube boiler. (See this issue.)

India.—April 7th. India Store Department. Telephone repeaters. (March 20th.)

BOMBAY.—April 20th. Bombay, Baroda, and Central India Railway. Supply of cables. (See this issue.)

London.—METROPOLITAN ASYLUMS BOARD.—March 31st. General engineering work, including centralised heating and h.w.s. systems, steam mains, &c., laundry and kitchen equipment, installation of electric lifts, installation of baker's oven, installation of electric lighting, auto fire alarms, electric clocks, &c., at the Grove Park Institution, Lee, S.E.12. (March 13th.)

BATTERSEA.—April 1st. Electricity Department. Two 750-kW converters, e.h.p. and l.p. a.c. and d.c. switchgear, three 250-kVA static transformers. (March 20th.)

Manchester.—April 2nd. Electricity Committee. Installation of lighting and heating circuits in the stores and house, High Street Depôt, Chorlton-on-Medlock. (March 20th.)

April 9th. 6,600-V sub-station switchgear, 6,000-kVA and 500-kVA static transformers. (See this issue.)

Motherwell.—The Burgh of Motherwell and Wishaw is inviting tenders for works (including electric lighting) in connection with 56 houses. Mr. A. Victor Wilson, B.Sc., A.M.I.C.E., Director of Housing, Motherwell.

New Zealand.—AUCKLAND.—May 25th. Auckland Electric Power Board. One 14-ton electrically-operated overhead travelling crane.*

WELLINGTON.—April 28th. Government Railway Department. A.c. electric motors.*

Rawmarsh.—March 30th. West Riding Education Committee. Electric light installation, Council schools. Mr. A. Adcock, divisional clerk, Godstone Road, Rotherham.

Richmond (Surrey).—April 20th. Education Committee. Installation of electric lighting at the Darell Road Council school. (See this issue.)

Southampton.—April 28th. Electricity Department. 10,000-kW turbo-alternator, with condensing plant; 50-ton electrically-operated travelling crane; 2,000-kW rotary-converter set, with transformer; starting panel, &c.; e.h.p. switch cubicles, control panels, indicating diagrams, &c.; d.c. switchgear; turbine boiler feed pump. (See this issue.)

South Africa.—JOHANNESBURG.—May 4th. Chief Storekeeper. Electric welding machine and converting apparatus for welding appliances.*

Truro.—April 13th. City Council. Provision of an electric lighting scheme for the city area. (See this issue.)

Uruguay.—MONTEVIDEO.—May 12th. State Electricity Works. H. and l.p. cables, telephone cables, junction and terminal boxes.*

Walthamstow.—April 8th. Electricity Department. One 7,000-kW turbo-alternator and condensing plant, one 1,000-kW motor converter, l.p. cables, and v.i.r. wires: (March 20th.)

Westhoughton.—April 3rd. Urban District Council. 12 months' supply of electric filament lamps. Forms of tender from Mr. G. Hayes, surveyor.

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Aberdeen.—Town Council. Accepted:—
Electric cables (£374).—Aberdeen Electrical Engineering Co.

Argentina.—CENTRAL ARGENTINE RAILWAY.—A contract has been placed with Messrs. Johnson & Phillips, Ltd., by the Central Argentine Railway for approximately a million yards of special cable for use in connection with the new electro-pneumatic signalling system now being installed.

Glasgow.—Electricity Committee. Recommended:—
Evaporator plant (£1,690) at the Dalmarnock power station.—Mirrlees Watson Co., Ltd.
Two 400-kVA transformers (£1,014).—Johnson & Phillips, Ltd.
Two transformers (£1,014).—Ferranti, Ltd.

Parks Committee. Accepted:—
Installing electric light at the new bandstands in Queen's and Alexandra Parks (£176, plus £65 for laying the service cable to Alexandra Park bandstand).—Glasgow Electricity Department.

Government Contracts.—The following Government contracts were placed during February, 1925:—

ADMIRALTY CONTRACT AND PURCHASE DEPARTMENT.
Charging boards.—Small Electric Motors, Ltd.; Whipp & Bourne, Ltd.
Electric overhead travelling crane.—T. Smith & Sons (Rodley), Ltd.
Lampholders.—General Electric Co., Ltd.; Sperryn & Co.; W. McGeoch & Co., Ltd.; Rainsford & Lynes, Ltd.; Edison Swan Electric Co., Ltd.
160-kW motor generators, control gear and spares.—Laurence Scott and Co., Ltd.
Electric travelling pulley block.—H. Morris, Ltd.
Plant for rotor testing.—Greenwood & Batley, Ltd.
Starter resistances.—Watford Electric & Mfg. Co., Ltd.
Fuse release switches.—Bertram Thomas; Whipp & Bourne, Ltd.
Holders for wireless valves.—H. W. Sullivan, Ltd.

WAR OFFICE.
Alterations to batteries.—Fuller's United Electric Works, Ltd.; Pritchett and Gold and E.P.S. Co., Ltd.
Generating set spares.—Blackstone & Co., Ltd.
Electric lighting installations.—Hounslow Barracks: Alpha Electrical and Mfg. Co., Ltd. Brompton Barracks, Chatham: T. Clarke & Co., Ltd. Kneller Hall, Twickenham: T. Clarke & Co., Ltd. Whittington Barracks, Lichfield: S. Dixon & Co., Ltd.

AIR MINISTRY.
Battery booster, &c. (Altrincham).—Electric Construction Co., Ltd.
Underground cables (Halton and Upavon).—Watshams, Ltd.
Lighting of Marconi masts (Ongar).—Marconi W.T. Co., Ltd.
Underground mains (Spittlegate).—G. E. Taylor & Co.

POST OFFICE.
Experimental apparatus.—Electric Furnace Co., Ltd.
Telephone apparatus.—British L. M. Ericsson Mfg. Co., Ltd.; General Electric Co., Ltd.; Phœnix Telephone and Electric Works, Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Testing and protective apparatus.—British L. M. Ericsson Mfg. Co., Ltd.; Phœnix Telephone and Electric Works, Ltd.; Siemens Bros. & Co., Ltd.
Wireless apparatus.—Harland & Wolff, Ltd.
Various cables.—British Insulated & Helsby Cables, Ltd.; Connollys (Blackley), Ltd.; Enfield Cable Works, Ltd.; W. T. Glover and Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Peel-Conner Telephone Works, Ltd.; Pirelli-General Cable Works, Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Joint-box castings.—Bradley & Turton, Ltd.; McDowall, Steven and Co., Ltd.; United Steel Companies, Ltd.; J. Williamson & Co., Ltd.
Leclanché porous cells.—General Electric Co., Ltd.
Parts for secondary cells.—Tudor Accumulator Co., Ltd.
Loading coils.—Western Electric Co., Ltd.
Ducts.—Albion Clay Co., Ltd.; Hepworth Iron Co., Ltd.; J. Oakes and Co. (Reddings Collieries), Ltd.
Electric lamps.—Edison Swan Electric Co., Ltd.
Earth plates.—G. Farmiloe & Sons, Ltd.
Distribution cable plugs.—Siemens Bros. & Co., Ltd.
Bronze wire.—F. Smith & Co.
Annealed copper wire.—J. Wilkes, Son & Mapplebeck, Ltd.
Switchboard wire.—General Electric Co., Ltd.
Manufacture, supply, drawing-in and jointing cable.—Kilmarnock-Irvine: W. T. Glover & Co., Ltd. Burton-on-Trent-Tamworth: W. T. Glover and Co., Ltd. Hanley-Alsager: Pirelli-General Cable Works, Ltd. Holborn-Hop, Battersea-Putney, and Royal-Clissold Junction: W. T. Henley's Telegraph Works Co., Ltd.
Mechanical tandem junction (London area).—W. T. Henley's Telegraph Works Co., Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.; Callender's Cable & Construction Co., Ltd.; Johnson and Phillips, Ltd.
Conveyors and chutes.—Edinburgh H.P.O.: Spencer (Melksham), Ltd.; sub-contractors for motors and starters: English Electric Co., Ltd.
Private telephone installations.—Benton & Stone, Ltd., J. & J. Hayes, Ltd., H. Gardner & Co., Ltd., W. & G. Du Cros, Ltd., M. Nairn and Co., Ltd., Shell-Mex, Ltd., J. Booth & Co., Ltd., E. S. & A. Robinson, Ltd.: Relay Automatic Telephone Co., Ltd.
Telephone exchange equipment.—Chiswick: Automatic Telephone Mfg. Co., Ltd. Walworth: General Electric Co., Ltd.; sub-contractors for batteries: D.P. Battery Co., Ltd.; for machines: Crompton and Co., Ltd. Speedwell: General Electric Co., Ltd. Ramsgate: General Electric Co., Ltd. Chiswick: Western Electric Co., Ltd. Edinburgh (Central): Siemens Bros. & Co., Ltd.; sub-contractors for batteries: Hart Accumulator Co., Ltd.; for charging machines: English Electric Co., Ltd.; for ringing machines: Crompton and Co., Ltd. Morriston (Swansea): Siemens Bros. & Co., Ltd.
Power plant for telephone repeater station.—Manchester: Newton Bros. (Derby), Ltd.; sub-contractors for batteries: D.P. Battery Co., Ltd.

H.M. OFFICE OF WORKS.
Main cables, &c., for H.M. Office of Works generating station, South Kensington.—W. T. Glover & Co., Ltd.
Electric lighting installation, H.M. Stationery Office.—Tredegars, Ltd.
Meters.—Ferranti, Ltd.

CROWN AGENTS FOR THE COLONIES.
Cable.—W. T. Glover & Co., Ltd.; St. Helens Cable and Rubber Co., Ltd.
Coaling plant.—Babcock & Wilcox, Ltd.
Stoneware conduits.—Doulton & Co., Ltd.
Telegraph ironwork.—Bullers, Ltd.
Copper wire, &c.—J. Wilkes, Sons & Mapplebeck, Ltd.

Irish Free State.—Contracts placed by the Controller of Stores, Department of Posts and Telegraphs, February, 1925:
Cable.—F. Routledge; Enfield Cable Works, Ltd.
Jointing compound.—P. V., Ltd.; W. H. Keys, Ltd.
Earthenware ducts.—Oates & Green, Ltd.; Standard Brick and Terra Cotta Co., Ltd.
Electric light fittings.—W. T. Henley's Telegraph Works Co., Ltd.; J. Lane & Sons, Ltd.; Siemens & English Electric Lamp Co., Ltd.
Switches.—Cable Accessories Co., Ltd.
Insulating tape.—Geo. Hattersley, Son, Ltd.
Telephone parts.—British L. M. Ericsson Mfg. Co., Ltd.; Sterling Telephone Electric Co., Ltd.; Western Electric Co., Ltd.
Telegraph apparatus.—Litholite Insulators, Ltd.; W. F. Dennis and Co.; David Willetts, Ltd. —*IRISH ELECTRICIAN.*

London.—BERMONDSEY.—Electricity Committee. Recommended:—
Meters.—Aron Electricity Meter, Ltd.; Chamberlain & Hookham, Ltd.; and Ferranti, Ltd.
Demand indicators.—Reason Mfg. Co., Ltd.
Time switches.—Venner Time Switches, Ltd.
Cut-outs.—W. T. Henley's Telegraph Works Co., Ltd.; and Universal Electrical Mfg. Co., Ltd.
Conduits, &c., for 12 months.—Roberts, Adlard & Co.
Lighting switches.—Universal Electric Mfg. Co.
Rewinding armature.—United Electrical Works, Ltd.
30-h.p. starter.—City Electrical Co.
Street lanterns.—General Electric Co., Ltd.; Holophane, Ltd.

In connection with the contract for electrical installation at the new baths (see ELEC. REV., February 27th and March 6th, under "Contracts Closed"), the Council in committee has recommended that of Messrs. V. G. Middleton & Co., Ltd., at £915.

ISLINGTON.—Electricity Committee. Recommended:—
Globes for electric lighting.—Edison Swan Electric Co., Ltd.

WESTMINSTER.—Baths Committee. Recommended:—
Re-wiring the Buckingham Palace Road swimming baths (£210).—Messrs. Coleby & Co.

METROPOLITAN WATER BOARD.—Recommended:—
Annual contract for electric lamps.—British Insulated & Helsby Cables, Ltd.; Falk, Stadelmann & Co., Ltd.; General Electric Co., Ltd.; Siemens & English Electric Lamp Co., Ltd.

HACKNEY.—Works Committee. Recommended:—
Six water tank bodies, with spraying apparatus, for fitting to the electrically-propelled vehicles used for house refuse collecting (£483).—Richard Garrett & Sons, Ltd.
End tipping bodies for two of the 2½-ton electric vehicles (£210).—Ransomes, Sims & Jefferies, Ltd.

Paddington.—GREAT WESTERN RAILWAY CO. Accepted:—
30-ton electric "Goliath" crane for Canons Marsh goods depôt, Bristol.—Clyde Crane and Engineering Co.

Richmond-on-Thames.—Town Council. Accepted:—
Cable to provide electric power to the new well in Petersham Meadow (£265).—Richmond (Surrey) Electric Light and Power Co., Ltd.

South Africa.—CAPE TOWN.—Electricity Committee. Recommended:—
5,000 Ferranti 10-amp., 220-V, a.c. meters.—Wilson & Herd.
L.p. a.c. switchgear for 11 sub-stations (£7,590).—A. Reyrolle & Co.

Southend.—Town Council. Accepted:—
Two Diesel engines (exclusive of hand rails round dynamo pits, flywheel, and engine spare parts) (£24,816).—Bellis & Morcom, Ltd. Two 750-kW d.c. generators (£3,100).—Lancashire Dynamo & Motor Co., Ltd.
One 750-kW alternator (£1,826).—Crompton & Co., Ltd.
Twenty-three tenders were received.

Tynemouth.—Electricity Committee. Accepted:—
500-kVA transformer (£440).—Hackbridge Electric Construction Co., Ltd.
250-kVA transformer (£247).—Metropolitan-Vickers Electrical Co., Ltd.

Willesden.—Electricity Committee. Recommended:—
30 switch cubicles (£2,935); equipment of Churchill Road sub-station (£4,213).—General Electric Co., Ltd.

Forthcoming Events.

Institution of Engineering Inspection.—Friday, March 27th. At the Royal Society of Arts. At 7.45 p.m. Discussion on "Remuneration for Inspection Work," to be opened by Mr. Davey and Mr. Gutteridge.

Nottingham Society of Engineers.—Monday, March 30th. At the Victoria Station Hotel. At 7.30 p.m. Paper on "Modern Super-Pressure Steam Practice," by Mr. D. Brownlie.

Electrical Trades Benevolent Institution.—Monday, March 30th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 3 p.m. Annual general meeting.

East London College.—Tuesday, March 31st. At the College, Mile End Road, E. Conversazione. Reception 7 p.m.

Societe des Ingenieurs Civils de France (British Section).—Wednesday, April 1st. At the Institution of Mechanical Engineers, Storey's Gate, S.W. At 6 p.m. Paper on "Traction on Rails by Internal-combustion Engines," by M. Brillié.

Institution of Electrical Engineers.—Thursday, April 2nd. At the Institution, Victoria Embankment, W.C. At 6 p.m. Discussion on "Electricity Supply Tariffs," to be opened by Mr. H. M. Sayers; and paper on "Electricity Supply Tariffs: Their Simplification by Discrimination," by Messrs. G. Wilkinson and R. McCourt.

(Wireless Section).—Wednesday, April 1st. At the Institution, Victoria Embankment, W.C. At 6 p.m. Paper on "The Lenfield Coupled Arc," by Major A. G. Lee.

(North-Western Centre).—Tuesday, March 31st. At the Engineers' Club, Manchester. At 7 p.m. Annual general meeting.

(South-Midland Centre).—Wednesday, April 1st. At the University, Birmingham. At 7 p.m. Paper on "The Post Office and Automatic Telephones," by Col. T. F. Purves.

Royal Institution of Great Britain.—Thursday, April 2nd. At 21, Albemarle Street, W. At 5.15 p.m. Lecture on "Chemical and Physical Effects of Light—Transmission of Light Images by Electricity," by Mr. T. Thorne Baker.

Junior Institution of Engineers.—Friday, April 3rd. At 39, Victoria Street, S.W. At 7.30 p.m. Lecturette on "Engineering Contracts," by Mr. G. W. Tookey.

(North-Western Section).—Monday, May 30th. At the Manchester Geographical Society, 16, St. Mary's Parsonage, Manchester. At 7.15 p.m. Informal meeting and election of new Chairman.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, April 4th. At the South Wales Institute of Engineers, Cardiff. At 6 p.m. Paper on "Operation of Modern Boiler House Plant," by Mr. E. K. Regan.

Institution of Engineers-in-Charge.—Saturday, April 4th. At the Holborn Restaurant. At 6 p.m. Annual dinner.

Electrical Power Engineers' Association (Northern Division).—Saturday, April 4th. At the Victoria Hotel, Manchester. At 5.30 p.m. Annual dinner.

The Dispute in the Printing Trades.

OWING to the dispute that has arisen between the Federation of Master Printers and the National Union of Printing, Bookbinding, Machine Ruling and Paper Workers, many weekly newspapers, including trade and technical publications, may be unable to appear at the usual time this week. We therefore ask the indulgence of our readers in case this particular number of the ELECTRICAL REVIEW should be late in delivery.

Notes.

Fatality.—A verdict of "Accidental death" was returned at an inquest held at Stainton on Irving Smart (17), labourer, of Stainton, who was killed at Maltby Colliery, near Rotherham, on March 9th. A witness stated that the deceased was engaged in driving a pony carting mortar from the mortar mill to the pit. Witness heard a scream, and on turning round saw that Smart had hold of a stay wire supporting a pole carrying a 500-V cable. He went to his assistance, but on touching him he himself received a shock, and he was unable to release the boy. Witness ran to the power house and had the current switched off, and artificial respiration was tried without success. The electrician at the colliery explained that about three weeks previously a loose end of wire had been put up as a temporary support for the strain wire until it could be fitted on to the insulator. Unfortunately, the loose end had been left on when the work had been completed, and probably the wind had blown it against the stay wire. The Coroner thought that no negligence could be attributed to anyone.

E.P.E.A. Dinner.—The fifth annual dinner of the London Western Section of the Electrical Power Engineers' Association was held in the Coventry Restaurant, Piccadilly, on Saturday, March 21st, Mr. W. Cornet presiding. Mr. A. W. Crompton, of the North-Eastern Section, in proposing the toast of "The E.P.E.A.," said that a well-organised body such as the E.P.E.A., working in co-operation with the employers, added efficiency to the industry, and only by co-operation could the best results be achieved; the initial letters, E.P.E.A., might very appropriately stand for "Efficient Power Everywhere Available." Mr. R. R. Telford, the President of the Association, in reply, said that in the House of Commons recently it was said that during the war great attachments were formed; he was sure that the E.P.E.A. was a great attachment of the war. Trade unions had come and gone, but the E.P.E.A. held its own and the relations between the E.P.E.A. and the employers were most pleasant. The Association's scheme of training was not yet accomplished, but it was certain that the National Joint Board would accept some training scheme modelled on it. Mr. W. J. Oswald, in proposing a toast to the visitors, said that co-operation with the contractors was essential to the success of the industry and the E.P.E.A. Organisation was absolutely necessary to realise the benefits of the industry, not to themselves only, but to the community as a whole. The scheme of training was a most important thing for the employers to engage upon, and provided a vast field to be explored. The desire of the E.P.E.A. was to be a real professional association. It was grateful for the sympathetic support it had received from the Press.

An excellent programme of music provided entertainment for all present during the evening.

The Illuminating Engineering Society.—The visit of this Society to the Waterloo Railway Station, referred to in our issue of March 13th, was the second of a series of informal visits and meetings arranged by the Society. A complete tour of the station was made under the guidance of Mr. A. Cunnington (lighting engineer to the Southern Railways). The general illumination of the Concours was examined, special attention being drawn to the roof lighting by gasfilled lamps in opal bulbs, designed to brighten the surroundings and remove the gloomy effect characteristic of stations where no light at all was allowed to pass upwards. After studying the lighting of platforms the visitors proceeded to the underground passage which serves for the conveyance of goods to the large number of platforms. Here attention was drawn to the method of mounting ceiling lights between projecting girders, with the result that there is a free view down the long passage and absence of glare.

During the discussion, Mr. Cunnington, by the aid of lantern slides, drew attention to a number of special problems met with at Waterloo. Amongst the points discussed were the special method of lighting the Concours, the provision made for ample illumination at places where tickets were collected, the devices for the guidance of passengers, which included the internal lighting of the time-table racks, and the need for good illumination, especially in the vicinity of lifts, for the purpose of assisting the police in the prevention of theft.

Educational.—EAST LONDON COLLEGE.—On Tuesday next a conversazione will be held at the East London College, to meet the Master and Wardens of the Drapers' Company. Music and dramatic entertainments will be provided, and lectures will be given on literary and scientific subjects, including a demonstration of "Talking Films" by Mr. C. F. Elwell, and a lecture on "Magnification of Sound" by Prof. J. T. MacGregor-Morris. The laboratories will also be open and experiments will be conducted in them.

NORTHAMPTON POLYTECHNIC INSTITUTE.—Entrance examinations for the 1925-26 session in connection with the Engineering Day College of the above Institute will be held on April 21st and 22nd, and September 22nd and 23rd. Each examination provides for admission at the commencement of the autumn term, 1925. Further information can be had on application to the Principal. (See our advertisement pages to-day.)

The Batti-Wallahs' Society.—On March 18th, the annual dinner of the Society was held at the Hotel Cecil; Mr. F. Pooley, president, was in the chair, and there was a large attendance of members and guests, including many ladies.

After the loyal toast, Mr. H. E. Blain, C.B.E., proposed "The Batti-Wallahs' Society," tracing its origin back to the days of Noah, when they made the ark light on Ararat, and relating many remarkable episodes in its history with which the members were previously unacquainted. In responding, Mr. Pooley gave the authorised version of the Society's history, but Mr. E. S. Barralet, proposing "The Visitors," gave a revised version. The Rt. Hon. Earl Stanhope, D.S.O., M.C., responded, claiming descent from the inventor of steamships, and declaring that the present Admiralty was eager to use new inventions; he advocated trade *under* the Flag, and expressed confidence in the men of the British mercantile marine and the engineering profession. The Hon. Lady Parsons, J.P., also responded, remarking that the Women's Engineering Society, of which she was president, was a small but enthusiastic body, and was grateful for the help and encouragement that it had received from engineers of all ranks.

Mr. W. Riggs, in a humorous speech, proposed "The President," referring to his long connection with the Society, and in reply Mr. Pooley said that, having occupied every possible position in its ranks, he was proud to be president when it was approaching the apex of its prosperity. He paid a tribute of appreciation to Mr. M. Whitgift, the hon. secretary, to whom he said the success of the Society was wholly due; and Mr. Whitgift, in response to the toast of his health, said he was glad that after many disappointments success had now been attained.

An excellent programme of music and song added to the enjoyment of a very successful occasion.

Electricity on a Scottish Farm.—A large company of agriculturists on March 19th witnessed the inauguration of thrashing machinery driven by electricity at the farm of Mr. A. B. Stevens, of Queenstonbank, Dirleton. A 4-kW dynamo provides light and power for the farm buildings and the house. It is coupled to a Ruston & Hornsby standard oil engine. The electrical work was carried out by Messrs. Provand & Cairns, Glasgow.

Late Legal. — WINDING-UP PETITION DISMISSED. — Mr. Justice Romer, in the Companies' Winding-up Court on March 24th, dismissed the petition of the Davis Electrical Co., Ltd., High Holborn, and the Electrical Supplies Co., Ltd., Tottenham Court Road, for an order for the compulsory liquidation of B. Barnett (Electrical Engineers, Leyton), Ltd. Mr. EDDY, for the petitioners, said they had agreed to accept 10s. in the £ and the payment of their costs.

ALLEGED INFRINGEMENT OF A TRADE MARK.—In the Chancery Division, on March 24th, Mr. Justice Tomlin, on the motion of W. B. Dick & Co., granted an injunction restraining Messrs. Kirkby & Tukes, Albany Chambers, Manchester (who were not represented) from infringing the plaintiffs' trade mark "Ilo," for electric transformer and switch oils, by using the word "Transilo," or any word which was a colourable imitation of "Ilo."

The E.D.A. Annual Meeting.—The annual meeting of the British Electrical Development Association is to be held on Friday, April 17th, at 12 o'clock, at the Hotel Cecil. The annual luncheon will follow.

Dance.—The Electricity Supply Commercial Association (London Division) will hold a "Select Dance" on Tuesday next, March 31st, from 7.30—11.30 p.m., at the Imperial Hotel, Russell Square, W.C.1.

Payment and Incentives in Industry.—A lecture on this subject was given under the auspices of the Industrial League and Council at the Regent Street Polytechnic on March 24th, Miss M. Partridge, B.Sc., in the chair, by Miss C. Haslett, editor of "The Woman Engineer," Secretary of the Women's Engineering Society, and director of the Women's Electrical Association. The questions of time and piece work, premium and collective bonus systems, co-partnership methods, and other means of adjusting payment and creating incentives, were examined, and the lecturer referred to the inevitable development of industrial policy and the greater share which the workers would take in the future partnership of capital and labour.

The Newcastle Electro-Harmonic Society.—The last concert of the first season of the Newcastle-upon-Tyne Electro-Harmonic Society took place on March 16th, the occasion being a ladies' guest night. Professor Thornton, D.Sc., occupied the chair. An excellent programme was provided by Mrs. Earnshaw (contralto), Mrs. Adamson (soprano), Mr. George Hodgson (tenor), and Mr. Harold Earnshaw (baritone), who sang as a quartette in addition to solo items; Mr. Frank Charlton (humorist), and Mr. W. J. Starkey (banjoist). Mr. J. G. Adamson, the hon. musical director, acted as accompanist performing a difficult task with great success.

Swan Memorial Lecture.—The second annual Swan Memorial lecture at Sunderland Technical College was given on Saturday, March 14th, by Dr. C. E. Hiatt, of the Edison Swan Electric Co., London, on the subject "Incandescent Lamp Manufacture from the time of Sir Joseph Swan to the present." The first lecture was given a year ago by Mr. Kenneth R. Swan, son of the inventor Sir Joseph Wilson Swan, a native of Sunderland, and was fully reported in our pages. Dr. Hiatt said that in spite of the advances of chemistry and physics, the carbon lamp was a most difficult lamp to produce. When he started in the business 15 years ago the carbon lamp was dying out and it had been dying ever since. The electric lamp industry was becoming more and more important and the markets of the world were far from saturated. In the United States the lamps which were sold in a year amounted to 1.74 per head of the population; in the United Kingdom, 0.42 per head; France, 0.72 per head; Germany, 0.88 per head; and Switzerland, 1.62 per head. Bad lighting was the rule and not the exception said Dr. Hiatt, and illuminating engineering was not receiving in the schools the attention it deserved. From the standpoint of efficiency in the workshops and offices, and the eye health of the nation as a whole, some of the real advances in the production of lamps were a curse instead of a benefit. Dr. Hiatt spoke of the enormous improvement in electric lamps since the days of the cellulose filament, the wonderful advance in lighting efficiency, and the tremendously reduced consumption costs with the gas-filled lamp of 1913 as compared with the carbon lamp of 1896. England now paid annually £19,000,000 for electric lighting. With equal illumination and using the same type of lamp as was in use less than 20 years ago, the bill would be £72,000,000, representing a national saving of £53,000,000. Gas-conductor or gas-discharge lamps, perhaps with fluorescent screens to make short wave-lengths possible, were a possibility.

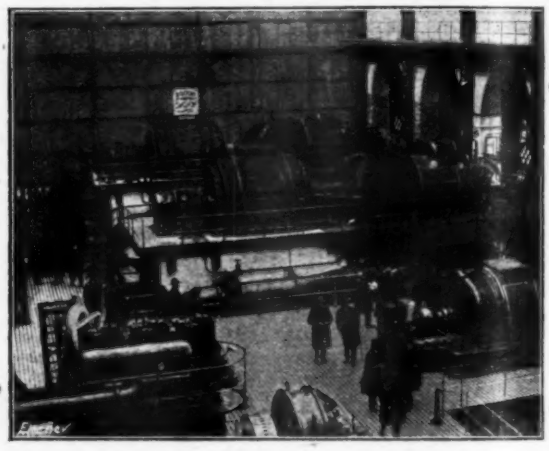
The Barking Power Station.—At the annual general meeting of the County of London Electric Supply Co., Ltd., on March 16th, Sir Harry Renwick, the chairman, made some very interesting statements regarding the new station at Barking. The station, which is situated on the Thames at Creekmouth, was designed by Messrs. Merz & McLellan, consulting engineers. The site has an area of 100 acres with a river frontage of 2,100 ft., and unlimited supplies of condensing water, and is capable of accommodating a power station of some 600,000 kW capacity, divided into three sections of 200,000 kW each. The first half section is now near completion, and considerable expenditure has been incurred in advance and in anticipation of the next extension up to 200,000 kW.

The buildings consist of the engine and boiler houses set at right angles to each other, and the switch house, control room and general offices, contained in one block set parallel to the engine house. The jetty and river works will allow at the present time ocean-going steamers of 3,000 tons to draw alongside, and ultimately 5,000-ton vessels will be able to come in. The plant at present installed includes two 15,000 kW and two 35,000 kW turbo-generators, designed to give a maximum flexibility, the alternators and condensers being interchangeable. The boiler-house is under the special control of a combustion engineer, so as to ensure the highest possible efficiency and the lowest operating costs, and to assist in this the station is equipped with a chemical laboratory under a qualified expert. The coaling and ash-handling arrangements are completely automatic, and coal can be discharged either direct from the steamers into the boiler-house bunkers or temporarily stored between the jetty and the power house.

The transmission lines connecting up the Barking power-house with the London area, consist of 33,000-V underground mains laid to three new sub-stations, and through these connect up with the existing stations and sub-stations.

Plant Extensions at Belfast.—On March 16th, the Lord Mayor of Belfast, Sir William Turner, started up a new 12,500-kW turbo-alternator recently installed at the Harbour power station. The extensions bring the plant capacity of the station, which was described in our columns on August 24th, 1923, up to 37,000 kW. They were carried out by the city electrical engineer, Mr. Johnstone Wright, M.I.E.E.

The new turbo-alternator is of Metropolitan-Vickers manufacture throughout, including the condensing plant. The turbine is fitted with Baumann exhaust and M.V. special twisted blading at the exhaust wheels. The condenser auxiliaries consist of one motor-driven air pump, extraction and lift pump set; a standby Le Blanc steam jet air pump, and



Interior of Harbour Power Station, Belfast.

a motor-driven extraction and lift pump. A steam ejector for producing quick vacuum is also fitted to the condenser. A Drysdale "Bon-Accord" pump of 20,000 gals. per hr. capacity, driven by a 3-phase motor, provides the circulating water, the pipework for which is fitted with hydraulically operated valves. A Weir steam pump of the same rating is also installed as a standby.

Extensions to the switch-house equipment consist of 8 new Reyrolle "A" type armourclad switches.

The photograph of the turbine room here reproduced shows the new machine next to the temporary wall. The sign seen over the turbine was illuminated when the turbine was started up.

Local Societies. — Some 30 members of the Edinburgh Electrical Society had a very enjoyable outing on Saturday, March 14th. Journeying by special 'bus the party visited the works of the Scottish Oil Co., Ltd., and was entertained to tea by the management.

Appointments Vacant.—Junior assistant mains engineer for the Hong Kong Electric Co., Ltd. Plumber-jointer for Peterborough Corporation Electricity Department. Turbine house attendant for the L.C.C. Tramways power station. Charge engineer for the Doncaster Corporation Electricity Department. Cable Jointer, for the Burnley Corporation Electricity Department. Assistant to the Electrical Engineer at the Cornwall Mental Hospital, Bodmin. (See our advertisement pages to-day.)

Institution Notes.

Institution of Electrical Engineers.—COOPERS HILL WAR MEMORIAL PRIZE.—The award of this prize is this year in the hands of the Institution of Electrical Engineers, and the Council has selected for the subject of competitive monographs "The Applications of Electricity to Metalliferous Mining." Papers submitted for the above purpose should reach the Secretary of the Institution not later than October 31st next. The award for 1925 is limited to corporate members of the Institution who were under 30 years of age on January 1st, 1925.

THE FARADAY MEDAL.—On Thursday last week the Faraday Medal of the Institution was presented to Sir Joseph J. Thomson, O.M., F.R.S. Dr. Eccles, in a brief address, referred to Sir Joseph as having followed in the footsteps of Faraday and Clerk Maxwell; his original work had exercised far-reaching influence on the advancement of science, and his discovery of the electromagnetic inertia of electrical charges in motion had led to the development of Einstein's theory. He first realised the importance of the electron, and by his own experimental work and that of his students he had effected a revolution in electrical science. The President, Mr. W. B. Woodhouse, in presenting the medal, expressed his appreciation of the splendid achievements of Sir Joseph, who briefly acknowledged the honour conferred upon him. Later, when dining with the Council, Sir Joseph remarked that he was particularly gratified because the Faraday Medal was awarded to him, an exponent of physical science, by a body of engineers engaged in the practical application of scientific principles; and he recalled many interesting episodes of the early days of electrical engineering. He referred to broadcasting as the most potent educational medium ever devised.

SUMMER MEETING.—The summer meeting of the Institution will be held at the South Midland Centre, June 9th—12th. Particulars are now obtainable from the secretary.

Junior Institution of Engineers.—On Friday last Mr. S. H. Hole read a paper on "Modern Transport," in the course of which he said that in his opinion the London Traffic Act was tending to drive 'buses off the road and make people travel underground, whereas the 'bus was not the real cause of traffic congestion. Describing goods vehicles, he mentioned that the worm drive was superseding the chain drive, and that four-wheel-drive lorries were useful for unmade roads and had a small turning circle.

Our Personal Column.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.

Sir BERTRAM HAYES, K.C.M.G., D.S.O., &c., who recently retired from the position of commodore of the White Star Line, has been appointed to the board of the Marconi International Marine Communication Co., Ltd.

The Wolverhampton Town Council has appointed Mr. LATTER as turbine-room superintendent at a salary of £421 per annum, and Mr. G. E. C. ATTWOOD as maintenance engineer at a salary of £392.

In a scheme of minimum and maximum salaries recommended for adoption to Glasgow Corporation, the present salary of the general manager of the Electricity Department is stated to be £1,500. The minimum, it is suggested, should be £1,500, and the maximum £2,000, and the increment £100 every two years.

In recommending that the salary of Mr. ALBERT GAY, the borough electrical engineer, be increased from £900 to £1,150 per annum, the Lighting Committee of the Islington Borough Council makes reference to the satisfactory development of the undertaking, to the installation of new plant and to the proposal to link up with St. Pancras and Hackney.

The Douglas (Isle of Man) Town Council has increased the salary of the borough electrical engineer to £500 per annum.

MR. JOSEPH BENTLEY, who is retiring after forty-three years' service with the Bradford Corporation, has been clerk to the Electricity Committee for twenty-five years and is to receive from that committee a resolution of appreciation on vellum.

Increases of salary recommended to Preston Town Council include:—Mr. J. F. SIMPSON (electrical engineer) £100, and Mr. H. CLAYTON (tramways manager) £25.

The Industrial Australian and Mining Standard states that Mr. W. S. CORNER has been appointed Chief Assistant Electrical Engineer in the New South Wales Railway Department. He will retain supervision over the departmental power system, including the Newcastle district.

The *Australasian Electrical Times* reports that Mr. P. J. PRINGLE, Manager of the Electric Supply Co., of Victoria, was leaving for England in February to confer with his company on matters connected with electricity supply and tramway running at Ballarat and Bendigo, Vic. Mr. H. P. SLIPPER, Australian manager of Messrs. Siemens Bros. & Co., Ltd., had left for England on his company's business. Mr. J. H. BUTTERS, C.M.G., chairman of the Canberra Commission, was recently "farewelled" by leading citizens of Tasmania. Mr. H. P. COLWELL, Chief Electrical Engineer, Victorian Railways, left Australia in January on a tour of the United States, Canada and Europe.

Southend-on-Sea Town Council has increased the salary of Mr. W. SHARP, engineer in charge of the Diesel plant, from £378 to £400 per annum, rising by £10 a year to a maximum of £450.

MR. RICHARDSON, charge engineer at the Doncaster Electricity Works, has been appointed rolling stock superintendent of the Doncaster Tramways.

MR. G. H. MARGRAVE, of Wakefield, who was appointed manager of the Chesterfield Corporation tramways a few weeks ago, has resigned the appointment of general manager of the West Riding Motor Company, with whom he was formerly an under-manager.

MR. A. H. DARKER, manager and engineer of the electrical department of Messrs. J. Stone & Co., of Deptford, who is, as already announced, on a long tour round the world, has just crossed the Andes into Chile from the Argentine and is in good health.

Mr. G. T. HICKLING is leaving the Midland Electric Manufacturing Co., Ltd., of Birmingham, to take up an appointment with Messrs. Santon, Ltd., of Newport, as their local representative.

At a special meeting of the Salford Technical and Engineering Association, held last Saturday evening, Mr. A. H. L. LUCAS, A.M.I.E.E., was presented with a silver tea and coffee set as a mark of appreciation of the valuable services rendered by him as honorary secretary of the Association for the last 17 years. Mr. Lucas, who, for nearly 30 years, has been connected with the manufacture of switchgear, holds an important position on the administrative staff of Messrs. Ferguson, Pailin, Ltd.

Obituary.—MR. W. W. BRADFIELD, C.B.E.—We regret to record the death of Mr. W. W. Bradfield, general manager of the Marconi International Marine Communication Co., Ltd., which took place in a London nursing home on March 17th, a few hours before his 46th birthday. He was born in London on March 18th, 1879. Practical radio-telegraphy owes much to Mr. Bradfield, whose connection with the Marconi Company dates from 1897, when he entered what was then known as the Wireless Telegraph and Signal Co., Ltd. For over a quarter of a century, therefore, he had been concerned with the development of wireless, particularly in connection with shipping,

The late Mr. W. W. Bradfield, C.B.E.

and it is stated that he was largely responsible for the efficiency of the maritime wireless services and the high standard which they have now reached. In both business and social life Mr. Bradfield's character endeared him to many and they keenly feel his loss. As electrical assistant to Senatore Marconi, in the earliest days of commercial wireless, he took part in experimental work on Salisbury Plain, and assisted in the erection of the wireless station at the Needles, Isle of Wight. In 1899 he installed the first wireless apparatus on British battleships, and a little later took charge of the demonstrations to the United States Government on board the U.S. battleship *Massachusetts*. In 1901 he undertook similar demonstrations before the French Government, when communication was established between the French Riviera and Corsica. In the same year he supervised the erection of the famous stations at Siasconset (Nantucket Island) and the Nantucket Lightship. By 1902 Mr. Bradfield had been offered, and had accepted, the position of chief engineer to the Marconi Wireless Telegraph Co. of America, and continued to hold this post until 1908, when he returned to England as deputy-manager of the parent company—Marconi's Wireless Telegraph Co., Ltd.—and of the Marconi International Marine Communication Co., Ltd. In 1910 he became manager of both concerns, and in 1917 he was elected to the board of directors of the two companies. Since 1920, when post-war reorganisation of

the Marconi companies became necessary, Mr. Bradfield had devoted his whole attention to the affairs of the Marconi International Marine Communication Co., Ltd. During his tenure of the post of chief engineer of the American Marconi Co., Mr. Bradfield took part in the second International Radio-Telegraphic conference which took place in Berlin in 1906. He was an Associate Member of the Institution of Electrical Engineers, a Fellow of the Institute of Radio Engineers (America), and an Associate of the American Institute of Electrical Engineers. During the war he devoted his entire energies to the support which the Marconi companies gave to the Services, and he was decorated with the C.B.E. for war service. Mr. Bradfield had been in failing health for some time but he could not be persuaded to follow the advice of his doctor and take the needed rest, and he broke down completely towards the end of last year and went to Switzerland for treatment. Unfortunately it was too late to restore him to health and he was brought back to London. The funeral took place on Friday last at Abney Park Cemetery, Stoke Newington.

MR. B. G. HUBBELL.—The death recently occurred in Buffalo, N.Y., at the age of 60 years, of Mr. B. G. Hubbell, who was regarded as the pioneer of the independent telephone system in the United States, and of the manufacture of radio apparatus. The deceased was president of the Federated Telephone & Telegraph Co. and the Federated Telephone Manufacturing Corporation.

DR. J. L. W. V. JENSEN.—The death occurred at Copenhagen, Denmark, recently, at the age of 66, of Dr. J. L. W. V. Jensen, formerly chief engineer of the Copenhagen Telephone Co., whose mathematical works gained him European fame. In 1912 the deceased was vice-president of the International Mathematical Congress at Cambridge.

MR. H. S. DAY.—The death is announced at Maidenhead, at the age of 61 years, of Mr. H. S. Day, who was one of the promoters of the Worcester Electric Traction Co. He became chairman of the company, chairman of four other electric tramway companies, and a director of six others.

Will.—The late SIR GUILFORD MOLESWORTH left £25,111 gross and £25,006 net personalty.

New Companies Registered.

Starnold, Ltd. (204,535).—Private company. Registered March 16th. Capital, £500 in £1 shares. To carry on the business of suppliers of, dealers in, and experts in wireless, wireless sets, apparatus and appliances, telephones, telegraphs, &c. The first directors are:—A. J. E. Starkey, 266, Old Christchurch Road, Bournemouth, manufacturers' agent; A. Reynolds, 9, St. Catherine's Road, Bournemouth, manufacturers' agent and radio engineer (managing director). Secretary: A. J. E. Starkey. Solicitors: Guillaume & Sons, Hampstead Chambers, Yelverton Road, Bournemouth. Registered office: 175, Old Christchurch Road, Bournemouth.

J. Churley Cann, Ltd. (204,542).—Private company. Registered March 16th. Capital, £500 in £1 shares. To adopt an agreement with J. C. Cann, and to carry on the business of factors and manufacturers of wireless components formerly carried on by him at 16-20, Farringdon Avenue, E.C. The first directors are:—Miss Beatrice M. Cann, 30, Ducie Street, Clapham, S.W.; Miss Florence E. Cann, 107, Highbury New Park, N.5. Solicitors: Corbin, Greener & Cook, 32, Bedford Row, W.C. Registered office: 16-20, Farringdon Avenue, E.C.

E. C. Trubridge, Ltd. (204,495).—Private company. Registered March 14th. Capital, £100 in £1 shares. To carry on the business of manufacturers of, agents for, and dealers in instruments and accessories used in radio telegraphy, &c. The subscribers (each with one ordinary share) are:—E. C. Trubridge, 12, Archer Street, Piccadilly, W., metal merchant; E. C. Coborn, 3, Denning Road, Hampstead, N.W., merchant. E. C. Trubridge is the first and permanent managing director.

Calmet, Ltd. (204,496).—Private company. Registered March 14th. Capital, £5,000 in £1 shares. To carry on the business of mica merchants and brokers, dealers in mica and micanite goods, &c. The first directors are:—A. G. Mason, 120, Wallwood Road, Leytonstone, E.11, merchant's manager; P. A. Peterson, 20, Ellesmere Road, Dollis Hill, N.W., accountant; E. M. Taunton, 11, Wilton Road, Birmingham, engineer. Secretary: Elsie M. Whitaker, 19, Alma Road, Canonbury, N. Solicitors: Good, Good & Co., 40, Chancery Lane, W.C.2. Registered office: Coventry House, South Place, E.C.2.

H. A. Stonham & Co., Ltd. (204,503).—Private company. Registered March 14th. Capital, £1,200 in £1 shares. To acquire the business of a radio and electrical engineer carried on by H. A. Stonham at Tunbridge Wells. The permanent directors are:—H. A. Stonham, M.R.E.I.C., 10, Woodbury Park Road, Tunbridge Wells, electrical engineer; H. Featherstone, A.M.I.E.E., 3, Cumberland Gardens, Tunbridge Wells, electrical engineer; E. G. Sanford, A.M.I.E.E., A.M.I.Mech.E., Alpha House, Grosvenor Road, Tunbridge Wells, electrical and mechanical engineer. Qualification: 50 shares. Secretary: E. G. Sanford. Solicitors: Harris, Templer & Passmore, 28, High Street, Tunbridge Wells. Registered office: 13, Mount Ephraim, Tunbridge Wells.

Contact Engineering Co., Ltd. (204,462).—Private company. Registered March 13th. Capital, £200 in 1s. shares. To carry on the business of manufacturers of, and dealers in electrical and engineering machinery and all parts, appliances, and accessories in connection therewith, engineers' machinists, smiths, electricians, &c. The permanent directors are:—T. H. Joyce, 85, Ladbroke Grove, W., merchant; L. A. Sawtell, 4, Chalfont Avenue, Wembley, engineer. Solicitor: Warden Gowing, 4, Sackville Street, W. Registered office: 219, Queen's Road, Bayswater, W.

Wireless Battery, Motor and Electric Lighting Co., Ltd. (204,550).—Private company. Registered March 16th. Capital, £1,000 in 450 "A" shares of £1, 400 "B" shares of 10s., 400 "C" shares of 5s., and 5,000 ordinary shares of 1s. To adopt an agreement between M. E. Roberts of the one part, and T. W. Goldie, E. Field, E. E. Fellows and Elizabeth J. Merrick (for this company) of the other part, and to carry on the business indicated by the title. The permanent directors are:—T. W. Goldie, "Hazelmere," Kingswinford, Staffs., stock and share broker; E. Field, Abbey Street, Lower Gornal, Staffs., engineer; E. E. Fellows, "Glaslyn," Wellington Road, Dudley, accountant; Mrs. E. J. Merrick, 52, Stourbridge Road, Scott's Green, Dudley, with £200 per annum as remuneration. Qualification, 500 ordinary shares. Registered office: 167, Union Chambers, Lower High Street, Stourbridge.

Accessories, Ltd. (204,515).—Private company. Registered March 16th. Capital, £500 in 300 8 per cent. preference shares of £1 each and 4,000 ordinary shares of 1s. each. To carry on the business of electrical engineers, manufacturers of electrical appliances, &c. The permanent directors are:—Dr. B. W. Gonin, "The Gables," Shortlands, Kent; S. J. Heale, 47, Essex Street, W.C.2, director. Solicitors: L. A. Blackbourn, 3, Staple Inn, W.C.1. Registered office: 47, Essex Street, Strand, W.C.2.

City Wireless Co., Ltd. (204,518).—Private company. Registered March 16th. Capital, £100 in £1 shares. To carry on the business of manufacturers of insulated wires and cables, wire and cable castings, wireless instruments and apparatus, &c. The permanent directors are:—S. A. Cohen, 2, Croxteth Grove, Liverpool (managing director of City Loan Co. (Liverpool), Ltd.; P. E. Beaver, 70, Edge Lane, Liverpool, financier. Qualification, £10. Secretary: P. E. Beaver. Solicitor: W. T. Sprott, 20, Victoria Street, Liverpool. Registered office: 175a, Scotland Road, Liverpool.

Lathartone, Ltd. (204,591).—Private company. Registered March 18th. Capital, £5,000 in £1 shares (2,000 10 per cent. cumulative preference and 3,000 ordinary). To acquire the business of a radio apparatus manufacturer and dealer carried on by M. W. Lawrence at 16, Duncan Terrace, Islington, N., as "M. W. Lawrence & Co.," and also the trade mark "Lathartone," No. 452,661, in Class 8. The first directors are:—M. W. Lawrence (permanent), Hillcrest, Carshalton Road, Sutton, Surrey; F. T. A. Power, Ferndale, Lime Tree Avenue, Peterborough. Qualification, 200 shares. Secretary: Miss F. J. Bennett. Solicitors: Barnes and Butler, 17, John Street, Bedford Row, W.C.1. Registered office: 16, Duncan Terrace, Islington, N.

Brownie Wireless Company of Great Britain, Ltd. (204,607).—Private company. Registered March 19th. Capital, £2,000 in £1 shares. To acquire the business carried on by J. W. Barber at 310a-312a, Euston Road, N.W.1, as the "J.W.B. Wireless Company," together with the two trade marks incorporating the word "Brownie," and to carry on the business of manufacturers, sellers, importers and exporters of, and dealers in wireless, telephone and telegraph apparatus, instruments, parts and accessories, &c. The subscribers (each with one share) are:—J. W. Barber, 4, Park Crescent, W.1, engineer; Mrs. D. Barber, 4, Park Crescent, W.1. J. W. Barber is permanent governing director and chairman. Solicitors: Blundell, Baker & Co., 16, Serjeant's Inn, E.C.4. Registered office: 310a-312a, Euston Road, N.W.1.

T. V. Rosewarne, Ltd. (204,623).—Private company. Registered March 19th. Capital, £5,000 in £1 shares. To acquire the business of a general engineer now carried on by T. V. Rosewarne at 10, St. Christopher's Place, Wigmore Street, W.1, as "T. V. Rosewarne," and to carry on the business of electrical, mechanical, constructional, motor, consulting and general engineers, &c. The permanent directors are:—T. V. Rosewarne, 10, St. Christopher's Place, W.1, engineer; O. S. Blackmore, address not stated; H. T. Smith, 10, St. Christopher's Place, W.1, engineer. Qualification, 750 shares. Secretary: H. T. Smith.

United Automatic Signs, Ltd. (204,624).—Private company. Registered March 19th. Capital, £2,500 in £1 shares. To carry on the business of manufacturers of electrical and other advertisement devices, advertising contractors, glass manufacturers, printers, electric light fitters, &c. The directors are: T. Bennett, 82, West Hill, Sydenham, S.E., advertising specialist; J. Andrews, 23, Danemere Road, Putney, S.W., printer. Remuneration as fixed by the company. Solicitors: Langdon, Sparks and Co., St. Mary's Chambers, 161a, Strand, W.C. Registered office: 146a, Queen Victoria Street, E.C.4.

Official Returns of Electrical Companies.

Dartmoor Electric Supply Co., Ltd. (110,871).—Return dated November 14th, 1924. Capital, £2,000 in 10s. shares. All shares taken up. £2,000 paid. Mortgages and charges: £4,000 4½ per cent. first debentures; £3,950 6 per cent. second debentures (£3,550 held by bank as collateral security).

British Gramophone and Wireless Co., Ltd.—J. C. Pidgeon, of 6, Old Jewry, E.C., ceased to act as receiver or manager on March 6th, 1925.

Lincolnshire Motor and Electric Traction Co., Ltd. (old company).—A. G. Pearson, of 1, Town Hall Street, Grimsby, ceased to act as receiver or manager on November 17th, 1924, in respect of first debenture dated April 1st, 1921. (Notice filed March 10th, 1925.)

Brentwood District Electric Co., Ltd.—Mortgage dated March 10th (supplemental to debenture dated February 19th, 1925, securing £20,000), charged on certain land in Brentwood. Holder: Solicitor to H.M. Treasury.

Erith Electrical Co., Ltd.—Particulars filed of £400 debentures authorised February 23rd, 1925, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Auto-Electrics, Ltd.—Debenture dated March 11th, 1925, to secure £100 charged on the company's property, present and future. Holder: F. E. Golding, 53, Litherland Park, Litherland, Lancs.

Peneast Signs, Ltd.—Debenture dated March 10th, 1925, to secure £1,500 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Mrs. A. Tessieres, 131, Pepy's Road, New Cross, S.E.

Eclat Electric Manufacturing Co., Ltd.—E. M. Carrington, F.C.A., of 2, Gresham Buildings, E.C.2, was appointed receiver and manager on March 12th, 1925, under powers contained in instrument dated August 10th, 1923.

Upton & Garrett, Ltd.—Sir Harold J. de Courcy Moore, of 2, Gresham Buildings, Guildhall, F.C.2, chartered accountant, ceased to act as receiver or manager on March 11th, 1925.

Morley Electrical Engineering Co., Ltd. (52,358).—Return dated February 23rd, 1925. Capital, £5,000 in £1 shares. All shares taken up. £3,980 paid. £1,020 considered as paid. Mortgages and charges, £3,000.

Suppliers Construction Co., Ltd. (66,081).—Return dated November 20th, 1924. Capital, £350,000 in £5 shares. All shares taken up. £350,000 paid. Mortgages and charges, nil.

W. G. Cannon & Sons, Ltd. (87,796).—Return dated December 22nd, 1924. Capital, £3,000 in £1 shares. All shares taken up. £9 paid. £2,991 considered as paid. Mortgages and charges, nil.

Marconi's Wireless Telegraph Co., Ltd. (53,403).—Return dated August 29th (filed October 9th), 1924. Capital, £4,000,000 in 3,750,000 ordinary and 250,000 7 per cent. cumulative participating preference shares of £1 each. £2,750,065 ordinary and 250,000 preferenc eshares taken up. £2,889,040 paid on 2,634,040 ordinary and 250,000 preference shares. £116,025 considered as paid on 116,025 ordinary shares. Mortgages and charges at date of return, £1,504,441 12s. 4d. (£70,595 since paid off).

Leamington and Warwick Electrical Co., Ltd. (13,780).—Return dated March 6th, 1925. Capital, £100,000 in 2,500 preference and 7,500 ordinary shares of £10 each. 1,100 preference and 6,800 ordinary shares taken up. £79,000 paid. Mortgages and charges, £35,000.

City Notes.

City of London Electric Lighting Co., Ltd.

The report for 1924, which was to be presented at the annual meeting on Wednesday last, shows that the capital expenditure during the year was £332,835. The four principal items were: Machinery and plant, £168,840; mains and conduits, £48,799; transformers and accessories, £42,642; and land and buildings, £46,351.

The balance available was £167,596 (after transferring £160,000 to reserve, £10,967 to benevolent fund, &c.), and after paying the preference and ordinary (15 per cent.) dividends, a balance of £37,396 is carried forward. The report deals with the London and Home Counties Electricity District and the London Electricity Supply (No. 1) Bill, and states that the latter will provide immediate and permanent advantage to the consumers, as in future every reduction in charges will be in the interest of both consumers and shareholders. Further new generating plant has been installed at the Bankside station and the second h.p. sub-station has been completed and put into operation. The work of changing over consumers to the new system is proceeding rapidly and satisfactorily, and it is anticipated that this will lead to substantial working economies. The company's offices have been removed to more commodious premises at Falcon House, Aldersgate Street. It is stated that anomalies have arisen as a result of the revision of the scale of charges in deference to the wishes of the Corporation of London and the London Chamber of Commerce. Should the company's Bill be passed, however, resources, which can be applied for their removal, will be released and a further revision of the tariff rendered possible. The average price charged for electricity during 1924 was 3.26d. per kWh; the company's authorised maximum charge is 8d. per kWh.

South London Electric Supply Corporation, Ltd.

The report for 1924 shows that the capital expenditure during the year was £20,226, bringing the total to £585,288. The bulk of the expenditure (£15,782) is attributed to mains. The balance at credit of the revenue account is £119,737, and the addition of £14,661 brought forward makes available £134,398. Debenture interest, &c., requires £6,504; the reserve for depreciation and renewals receives £19,000; £5,000 is carried to taxation reserve and £50,000 to general reserve, leaving £53,894. After the payment of the final dividends (10 per cent., making 15 per cent. for the year, in the case of the ordinary shares) a balance of £13,094 will be carried forward. The applications received during the past year amounted to the equivalent of 1,252 kW, making the total 24,025 kW. The amount of energy sold increased from 12,028,137 to 13,670,496 kWh.

Notice was given of an extraordinary meeting to be held after the annual meeting yesterday (Thursday) to approve an agreement between the company and other London supply companies. A further meeting was to be held to sanction methods of dealing with the reserves.

Chelsea Electricity Supply Co., Ltd.

The annual meeting of this company, whose report was reviewed in our last issue (p. 468), was held on March 18th. Mr. W. R. Davies (chairman), in the course of his speech, said that the results were the best in the history of the company. The company sold about 900,000 kWh more than in 1923, an increase of 14 per cent., although the connected load increased by less than 3 per cent., showing increased use by existing customers. The company was now practically only a distributing company, some 95 per cent. of the electricity sold being supplied by the Central Electric Company. This was a position which all the London companies would occupy if the Bills before Parliament became law. Under the London Electricity Supply (No. 2) Bill with which the company was concerned, the generating stations and main transmission lines would be leased to the London Electricity Joint Committee, Ltd., in which the company was a shareholder. From that company they would obtain electricity at a price not greater than at present, and, if the view that supply from "super stations" would result in greater economical working was correct, it would cost less. As the company had for many years added to the renewals, depreciation, &c., reserve, amounts considerably in excess of those which the Inland Revenue authorities allowed, a portion of the £150,000 at which that account stood should be available to add to the free reserves. When the exact amount had been ascertained it would be capitalised in the form of shares and distributed to the shareholders as a bonus. These were the reasons why the dividend had not been raised and half the profits had been devoted to the reserves. The terms on which the undertaking would be acquired by the Joint Committee were stringent, but perhaps better than being taken over in 1931, when the present Provisional Order would expire. The report and accounts were adopted.

Metropolitan Electric Supply Co., Ltd.

The annual meeting of the company was held on March 17th. Mr. A. W. Tait, C.B.E., who presided, in moving the adoption of the report and accounts, said that the gross revenue had increased from £631,724 to £685,010, and the balance carried to net revenue account from £210,081 to £217,732, enabling an increase to be made in the ordinary dividend, and a larger sum to be carried to reserve. There had been an increase of 16 million kWh in the supply, although 12 million kWh represented the load taken over from the Uxbridge Company. The growth in the business was represented by the addition of connections amounting to 10,260 kW, making the total connected load 81,700 kW. As the chairman had mentioned at the last meeting, bulk supply agreements had been entered into with the Colne Valley Co., the Twickenham and Teddington Co., and the Egham and Staines Co. During the past year further agreements had been made with the Ealing Borough Council, the Slough and Datchet Co., and the Chesham Co. In a number of these cases supply had already commenced. The arrangements to link up the undertaking of the Chesham Electric Light and Power Co. were well in hand, and it was hoped to close the Chesham station down during the current year; this would effect economies in generation. A further 12,000-kW generating set, with the necessary boiler equipment, &c., had been installed at the Willesden station, and considerable sums had been spent in extending the mains in London and the western area. The growth in the demand would necessitate further plant extensions, both in the Willesden station and the sub-stations, as well as cable extensions. The increased revenue had been obtained in the face of reduced charges to consumers which represented a loss of £40,000 to the company. There was an improvement in the generating costs as a result of the recent capital expenditure. As regarded the current year the improvement, both of bulk supplies and of the load in the company's own area, continued.

The Chairman then reviewed at some length the provisions of the London Electricity Supply (No. 2) Bill and its effects.

The report and accounts were adopted and the directors were authorised to take such steps as were necessary to protect the shareholders' interests.

Folkestone Electricity Supply Co., Ltd.

The report for the past year states that the profits from the three undertakings (including receipts from hired installations) amounted to £37,792. To this is added £1,498 brought forward, and from it are deducted debenture interest, preference dividend, &c., leaving £29,440. Of this £16,128 is transferred to the depreciation fund (making £84,618), £4,000 to the reserve fund (making £28,779), and £2,084 is written off in respect of changing over the Hythe system of supply. A final dividend of 6 per cent., free of tax (making 10 per cent., tax free, for the year), is recommended on the ordinary shares and £1,498 is carried forward. During the year 50,000 ordinary shares of £1 each were issued and taken up.

Accompanying the report are details of resolutions which the shareholders are to be asked to approve at to-day's meeting. The first of these proposes to increase the capital to £200,000 by the issue of 50,000 shares of £1 each, of which 40,000 would be ordinary shares and the balance "employés' co-partnership shares." The next resolution provides for the allocation of these latter shares to employés. A third resolution provides for the capitalisation of profits as and when considered fit.

County of London Electric Supply Co., Ltd.

Sir Harry Renwick, K.B.E., presided at the annual meeting on March 16th. In presenting the report and accounts (*vide* ELEC. REV., March 13th, p. 428), he said that the year had been a very satisfactory one. The company's business had improved; the London supply problem was settled; and the Barking station was practically completed. Over £488,000 had been added to the reserves from the profits of the past year, and the total reserves, including the carry-forward, amounted at December 31st last to £1,779,000. The same dividend had been paid on a larger amount of capital.

Leaving the accounts, the Chairman spoke at some length upon the Barking station. He said that the site would accommodate a station of 600,000 kW capacity and it was proposed to carry out the work in three equal sections. The first half of the first section, consisting of two 35,000-kW and two 15,000-kW sets, with the necessary auxiliary plant, had now been practically completed. A special feature of the new station was the automatic coal-handling equipment. Underground 33,000-V mains carried the power to three new sub-stations in the London area and through these connected up with the previously existing stations and sub-stations. The contracts had been placed on exceptionally favourable terms with the result that the capital cost per kilowatt was below that of any station of comparable size erected since the war. The company was in an exceptionally favourable position to deal with practically unlimited industrial, bulk, and railway supplies at a time when they were most needed.

Speaking of the schemes for the reorganisation of electricity supply in London and the Home Counties, Sir Harry Renwick said that the companies were taking a new lease of life freed from certain restrictions of the past. The Bill promoted by the company and its associates had passed its second reading in the House of Commons and the Bill was then before a Committee of the House (*vide* "Parliamentary" in this issue). The chairman outlined the provisions of the Bill, and also made reference to the rejection of the company's Essex Bill, mainly on the ground that the company was not on the King's Roll, although it was employing 12 per cent. of disabled ex-Service men instead of the stipulated 5 per cent. The company had, however, now had its name placed on the Roll.

Turning to the future of electricity, Sir Harry said that we were undoubtedly passing through an industrial revolution similar to that which took place when steam was first adopted in this country. The old order of things was fast passing away, and although, owing to faulty and restrictive legislation, we were still much behind other countries, yet substantial progress had been made in the past few years. The generating plant in this country had increased by over 90 per

cent. during the past four or five years, while in the last three years there had been an increase of 30 per cent. in the amount of energy generated. The present consumption per head in this country was about 200 kWh as compared with 500 kWh in the United States. A great improvement could be looked forward to in the next few years, and so far as London was concerned the consumption per head of population should be doubled in the next five years. There was no country in the world more suited and more ripe for a big electrical development than Great Britain, by reason of the density of the population, the compactness of the industrial areas, and the comparative short distances between the towns and cities. In the electrical development so far achieved the municipal undertakings as well as the companies had played their part. Too much credit could not be given to the Electricity Commissioners who, during the past five years, had done good work in spite of their limited powers. The speaker was of the opinion that their powers should be extended if they were to give full effect to the policy for which they were called into being—the provision of a cheap and abundant supply of electricity throughout the country. Such a supply would reduce working costs and increase production to a far greater extent than any political propaganda could effect. In concluding his speech the chairman mentioned that the new Barking station would be opened by the King on May 19th.

Later, in replying to a vote of thanks, Sir Harry said that the prospects for the current year were excellent; there were improvements in every department. He asked the shareholders, however, not to look for too great economies in working costs from the new station during this year for it would not be until the end of the year that all arrangements would be completed.

West London and Provincial Electric Supply Co., Ltd.

In his speech at the annual meeting on March 18th, Mr. Harry Kahn, the chairman, reminded the shareholders that the whole of the company's income was derived from the Chiswick Electricity Supply Corporation, Ltd. The report of the latter company, the whole of whose capital is held by the West London Company, was reviewed in our last issue (p. 468). Mr. Kahn said that after paying the dividend on the preference shares, and interest on the funding certificates, it was proposed to pay an ordinary dividend of 7½ per cent., to redeem the outstanding funding certificates, and to carry forward £620. The resolution was adopted.

Newcastle and District Electric Lighting Co., Ltd.

The annual meeting of Newcastle and District Electric Lighting Co., Ltd., was held on March 20th, Colonel F. R. Simpson (chairman) presiding. The chairman, moving the adoption of the report (Elec. Rev., March 20th, p. 468), said that during the year the capital expenditure was £41,484, mainly for cables laid to meet the requirements of new consumers and the erection of sub-stations. The increasing demand for electricity for lighting and other domestic purposes was very satisfactory. Some of the new housing schemes in the company's area had already adopted electricity, and as its advantages and economies became more widely known, the demand would undoubtedly further increase.

Bournemouth and Poole Electricity Supply Co., Ltd.

The balance at the credit of the revenue account for 1924 is £153,181, and to this is added £7,941 brought forward, making £161,122. Debenture interest, redemption funds, &c., absorb £10,491; £25,000 is allocated to depreciation, renewals, &c.; and £65,000 is transferred to reserve, leaving £59,638. The preference and interim ordinary dividends have absorbed £20,758; it is proposed to pay a final dividend at the rate of 5½ per cent. on the ordinary shares (making 10 per cent. for the year, less tax), together with a bonus of 4 per cent., free of tax. A balance of £10,881 is carried forward. The capital expenditure during the year was £46,296, the principal item being mains (£30,392). The applications for supply during the year totalled 1,758 kW, making the aggregate 22,777 kW, and a total of 9,176,358 kWh was sold. The municipal authorities, which have the right to purchase the company's Provisional Order undertakings in 1932 and 1941, have formed a joint committee to deal with the matter, and negotiations for the extension of the company's tenure are pending. Meeting: March 31st.

British Insulated and Helsby Cables, Ltd.

Mr. James Taylor presided at the annual meeting on March 23rd, and in moving the adoption of the report and accounts (Elec. Rev., March 20th, p. 468), said that the profits for the past year had been higher; this was due to an increased turnover rather than to a higher rate of profit. The works had been engaged at their full capacity and the turnover was the largest in the history of the company. It had been found necessary to extend the wire-drawing and other departments at the Prescot works at a cost of over £250,000, and owing to the company's conservative financial policy the whole of the sum required was available without raising fresh capital. It was expected that most of the new plant would be brought into use during the summer of the current year. Foreign competition would be more formidable in the future than it had been in the past, and keeping in view the low prices which the company had had to quote to secure orders, especially abroad, they had provided a reserve of £150,000 to meet those circumstances and enable them to maintain their business connections. Among other things this would provide continuity of employment for their workpeople of whom there were now about 7,700. The contracting department did a considerably increased business in 1924. This department was engaged primarily in laying the cables, which the company sold to its customers, and in the construction of overhead transmission lines and electric railway equipment. The company had obtained important railway contracts in South Africa and India; the first section of the work under the latter contract had been opened for traffic. The company had won its appeal and the final appeal of its opponents had been dismissed in the litigation regarding lamp patents. In spite of the uncertainty the lamp business again showed a satisfactory result for the year. The difficulties which beset the establishment of an Indian cable factory were fast disappearing, and it was hoped that they would soon be able to report that the business was progressing satisfactorily. The bulk of the 4½ per cent. first mortgage debenture stock and the 5 per cent. second mortgage debenture stock had been redeemed and the remainder would soon disappear. In the place of these there was now £700,000 5 per cent. mortgage debenture stock which had been over subscribed. The reserves had been considerably strengthened and as a result the carry forward was lower. The company's buildings, plant and machinery had been kept in good order and the amount allocated to depreciation had been increased.

Turning to the subsidiary interests, the chairman said that the Midland Electric Corporation had again done well and had paid a 15 per cent. dividend. New and up-to-date generators had been installed at the Bendigo and Ballarat stations of the Electric Supply Co. of Victoria, and there was reason to believe that the value of this property would be greatly enhanced. Through their holding in the International Automatic Telephone Co. they had a considerable interest in the Automatic Telephone Mfg. Co., which was doing well. In conclusion, Mr. Taylor paid a tribute to the staff. The report and accounts were adopted.

British L. M. Ericsson Manufacturing Co., Ltd.

The directors' report for the past year states that the turnover represented an increase of 33 per cent. upon the 1923 figures and was the highest in the history of the company. The net profit (after providing for debenture interest, depreciation, &c.), was £54,750, as compared with £28,302 in 1923, and the addition of £34,107 from the last account makes available £88,857. It is proposed to pay a dividend of 16 per cent. on the ordinary shares, to transfer £15,000 to general reserve, and £15,000 to special reserve, leaving £40,456 to be carried forward. The meeting was to be held yesterday (Thursday).

British Aluminium Co., Ltd.

The report for 1924, which is to be presented at the annual meeting to-day (Friday), shows a net profit of £491,974, to which is added £18,071 brought forward, making £510,045. After providing for taxation, debenture service, &c., and allocating £120,000 to the reserve account, £50,000 to depreciation and £10,000 to the staff benefit fund, there is a balance of £139,321. From this the preference dividend and the interim ordinary dividend are deducted, and it is proposed to pay a final dividend at the rate of 15 per cent. on the ordinary shares (making 10 per cent. for the year), and to carry forward £21,243. The debenture redemption accounts now stand at £306,118, and the depreciation reserve at £700,000, a total of £1,006,118. The reserve account amounts to £400,000. The capital expenditure during the year was £31,482. The whole of the works and plant were maintained out of revenue. The demand for aluminium continued to be satisfactory throughout the year and all the works were operated, as far as possible, at full capacity.

Electric Supply Corporation, Ltd.

The gross earnings during 1924 were £101,387, an increase of £10,048 upon the previous year's figures, and the sum taken into net revenue account amounted to £45,008. After providing for the preference and interim ordinary dividends, &c., there remained a surplus of £33,842. It was proposed to transfer £10,000 to the repairs and renewals fund, and £5,000 to the general reserve fund; to write off £2,000 in connection with the preference share issue; to pay a final dividend of 6 per cent. (making 10 per cent. for the year, as in 1923) plus a bonus of 1 per cent., on the ordinary shares; and to carry forward a balance of £6,342. The table of progress shows that the 33-W lamp equivalent of connections rose from 400,775 to 428,401 and the number of kWh sold from 7,402,218 to 9,397,486. The increase was common to all of the company's eleven stations. The report states that the Hendon Electric Supply Co. has paid a dividend of 15 per cent., but that the Dumbarton Burgh and County Tramways Company has again been unable to pay a dividend. The Dawlish and North Berwick companies have not yet published their accounts. The meeting was to be held yesterday (Thursday).

German Companies.

The *Rhenish Electricity Company*, of Mannheim, reports that the payment of a dividend for 1924 can be reckoned on. At the end of that year the situation of business in all departments was satisfactory, so that it was possible again to bring into full operation the branch factories which were stopped in 1923.

The *German Telephone Works and Cable Industry Company*, of Berlin, which has just reduced its paper mark capital to a gold mark basis, reports that the cable factory was well occupied in 1923-24. The course of business in the present year is stated to have so far been satisfactory.

The *Transradio Company*, of Berlin, reports an increase of

38 per cent. in the traffic in 1924. At the beginning of that year the company secured the establishment of a connection with South America, and a direct communication between Nauen and the Dutch East Indies has been effected in the current year. It is proposed to pay a dividend at the rate of 8 per cent. out of the net profits of 1,420,000 Reich marks.

French Companies.

The *Société Energie Electrique du Sud-Ouest*, of Paris, reports a net profit of 16,805,070 fr. for the past financial year, as compared with 13,053,330 fr. in 1923.

La Société Havraise d'Energie Electrique, of Le Havre, is increasing its capital from 35 to 45 million francs and is inviting subscriptions for 40,000 new 250-fr. shares at 325 fr. each.

Eclairage et Force par l'Electricité.—At an extraordinary meeting of this company, whose existence should have come to an end on July 2nd, 1920, it was decided to prolong its life until December 31st, 2024. It was also decided to double the company's capital by the issue of 40,000 shares of 250 fr. each. The shareholders also authorised the board to raise the capital to 30,000,000 fr. in one or more instalments at its option.

Stock Exchange Notices.—The undermentioned have been ordered to be officially quoted:—

Chili Telephone.—31,200 shares of £5 each, fully paid, Nos. 118,801 to 150,000.

Midland Counties Electric Supply.—25,000 ordinary shares of £1 each, fully paid, Nos. 975,001 to 1,000,000; and 250,000 six per cent. cumulative preference shares of £1 each, fully paid, Nos. 750,001 to 1,000,000.

Application has been made to the Committee to allow the following to be officially quoted:—

Manila Electric Corporation.—280,000 common shares of no nominal or par value.

North British Aluminium.—Scrip fully and partly-paid, for £2,500,000 four and a-half per cent. guaranteed debenture stock, 1931-1955.

Stanton Ironworks.—Scrip, fully and partly-paid for £1,000,000 four and a-half per cent. guaranteed debenture stock, 1931-1945.

Sudan Construction and Equipment.—Scrip, fully and partly-paid, for £40,000 four and a-half per cent. guaranteed debenture stock, 1931-1945.

Dealings in the following have been specially allowed by the Committee under Rule 159:—

Agricultural and General Engineers.—3 000 ordinary shares of 10s. each, fully paid, Nos. 1,326,713 to 1,328,712 and 1,462,107 to 1,463,106.

Manila Electric Corporation.—280,000 common shares of no par value.

Companies Struck off the Register.—The undermentioned companies have been struck off the Register and are thereby dissolved:—

Globe Electric Co., Ltd.
Little Wonder Battery Co., Ltd.
Marzi Loud-Speaking Telephone Co., Ltd.
Railless Electric Traction Co., Ltd.
Telephone Co. of Egypt, Ltd.

Prospectus.—*Mid-Cheshire Electricity Supply Co., Ltd.*—The lists are to be opened on March 30th and closed on or before April 4th in an issue of 50,000 ordinary shares and 50,000 7 per cent. cumulative preference shares at par. The new capital is required for the extension of the supply afforded by the company (which was formerly the Northwich Electric Supply Co., Ltd.) to Knutsford, Middlewich, and Winsford, to acquire the Weaverham electricity undertaking, &c.

Madras Electric Supply Corporation, Ltd.—The *Financial News* states that proposals for the reorganisation of the capital are under consideration. It is proposed to increase the capital to £653,000 by the issue of 273,600 new preference shares of £1 each, primarily to redeem the outstanding balance of the first mortgage debentures. It is also proposed that the existing preference shares, as well as the new issue, shall carry a fixed cumulative dividend of 5½ per cent., free of tax, instead of 6 per cent., less tax, as at present, representing an increase in the net rate from £4 13s. to £5 10s. per cent. It is proposed to issue 250,000 of the new shares during the next few weeks.

Direct Spanish Telegraph Co., Ltd.—The accounts for 1924 show a balance (including the amount brought forward) of £13,731, and after the payment of the preference dividend and a dividend of 10 per cent. (free of tax) on the ordinary shares, a balance of £4,266 is carried forward. The company's cables were cut by steamers on two occasions but the interruptions were only short ones, *viz.*, on the Marseilles-Barcelona cable 22 hours, and on the Porthcurnow-Bilbao cable 7 hours. The traffic receipts showed a decrease of £684. Meeting: April 2nd.

Bell Telephone Co. of Canada.—The president of the company, at the recent annual meeting, said that during the next five years the company would require nine or ten million dollars of new capital to enable it to meet the growing demand for service. A resolution was approved increasing the company's capital from $50,000,000 to $75,000,000.

Robey & Co., Ltd.—During 1924 there was a trading loss of about £18,000, and the net deficit, after crediting the amount brought forward, is £12,788. In 1923 the preference and ordinary shares received a dividend of 2½ per cent.

Erinoid, Ltd.—An interim dividend at the rate of 10 per cent. has been declared for the six months ended February 28th last.

Yorkshire Electric Power Co.—It is reported that the issue of 500,000 ordinary shares of £1 each was subscribed for two and a-half times over by the existing shareholders.

Slough and Datchet Electric Supply Co., Ltd.—The profit for the past year (including £4,320 brought forward) was £20,092. After transferring £3,500 to the special reserve, £4,500 to the depreciation, renewal and reserve fund, and paying directors' fees and tax, there is an available balance of £11,392. An interim dividend of 4 per cent. has been paid and it is now proposed to pay a final dividend of 6 per cent., plus a bonus of 4 per cent. The 15,000 new shares which were issued in June last rank for dividend from July 1st on 10s. per share. The dividend for 1923 was 10 per cent. A balance of £4,475 is carried forward. The extension of the company's mains to Burnham has been attended by satisfactory results. The amount of energy sold increased from 2,842,280 to 3,132,324 kWh.

Windsor Electrical Installation Co., Ltd.—The report for 1924 states that the profit (including £2,913 brought forward) was £16,847. The balance available, after deducting directors' fees, debenture interest, preference dividend, &c., and transferring £3,000 to the depreciation, renewal and reserve fund and £2,500 to special reserve, is £9,455. A final dividend of 6 per cent. (making 10 per cent. for the year, as in 1923) is recommended on the ordinary shares, together with a bonus of 4 per cent., leaving £4,030 to be carried forward. The directors have decided to reduce the charges by 1d. per kWh for power and ½d. per kWh for lighting at the end of the March quarter.

Indian Radio Telegraph Co., Ltd.—*Reuter* reports that the prospectus of this company, working under a concession from the Indian Government, has been issued with a capital of three crores of rupees, divided into 200,000 one-hundred rupee ordinary shares, and 100,000 deferred shares, of which 27,000 ordinary and 18,000 deferred shares are being now issued. 10,800 ordinary shares are being issued for cash to Marconi's, who are being credited with all the deferred shares. The prospectus mentions that the first station will be erected at Poona, and equipped for the Marconi beam system.

Stewarts & Lloyds, Ltd.—The net profit for 1924, after writing off £25,124 for expenses of the issue of deferred shares and setting aside £100,000 for depreciation, was £478,960. With £101,795 brought forward the amount available is £580,155. It is proposed to transfer £50,000 to reserve and £10,000 to the employés' benefit reserve, to pay a dividend of 2s. 6d. per share on the old and 5d. per share on the new deferred shares, and to carry forward £135,697.

Tyneside Electrical Development Co., Ltd.—The profit for the year ended January 31st, including £629 brought forward, was £4,532. Of this amount £500 is transferred to general reserve, and it is proposed to pay a final dividend on the preferred ordinary shares, making 6 per cent. for the year, and a dividend of 6 per cent. on the deferred ordinary shares, leaving £732 to be carried forward. The same rates of dividend were paid for 1923.

American Telephone & Telegraph Co.—The net earnings during 1924 totalled $107,619,362, an increase of $12,229,444. Interest charges absorbed $16,573,041, and dividends $70,918,227. Of the balance $3,000,000 was reserved for contingencies, and $17,128,094 carried over. At the annual meeting a proposal to increase the capital from $1,000,000,000 to $1,500,000,000 is to be submitted.

Newmarket Electric Light Co., Ltd.—The directors' report for 1924 showed a balance of £2,302, after providing for debenture interest, depreciation, &c., and to this was added £526 brought forward, making £2,828. A dividend of 6 per cent., free of tax, is paid; £750 is transferred to general reserve, and £485 is carried forward.

P. & W. Maclellan, Ltd.—To the 1924 profits of £12,482 are added £25,802 brought forward and £5,000 from reserve. It is proposed to pay the preference dividend, to allocate £5,000 to depreciation, and to carry forward £13,534. In the previous year a dividend of 3 per cent. was paid on the ordinary shares.

Barcelona Traction, Light & Power Co., Ltd.—A dividend of 1 per cent. has been declared on the 7 per cent. non-cumulative participating preference shares.

Consolidated Gas, Electric Light, and Power Co. of Baltimore.—The net income for 1924 was $4,089,560, as against $4,906,012. After paying dividends there was a surplus of $2,004,236, making the total surplus $6,458,503.

Constantinople Telephone Co.—By a misprint in our report of the meeting of this company (ELECTRICAL REVIEW, March 13th), the name of the chairman, Sir Alexander Roger was given, in error, as Roget.

Northern General Transport Co., Ltd.—A final dividend at the rate of 7½ per cent. has been declared on the ordinary shares, making 10 per cent. for the year, as against 7½ per cent. for 1923.

Sir W. G. Armstrong, Whitworth & Co., Ltd.—A final dividend of 6d. per share has been declared on the ordinary shares, making 1s. for the year, as in 1923.

Scottish Tube Co., Ltd.—A dividend of 4 per cent. is recommended on the ordinary shares; no ordinary dividend was paid for 1923.

Browett, Lindley & Co., Ltd.—The loss for 1924 was £12,094. £15,000 is transferred from the reserve and £476 brought forward, leaving £3,381 to be carried forward. There was a loss of £7,343 in 1923.

Stocks and Shares.

Monday Evening.

Stock Exchange markets are moving on a fairly even keel, though it cannot be said that the monetary fears have subsided. In fact, there seems to be a disposition to regard the outlook as being one which at the present moment is charged with uncertainty, depending a good deal upon the manner in which New York may act in the near future. If there should be another rise in the Bank Rate, this would unquestionably exercise a sharp effect upon prices, but the expectation in the Stock Exchange is that such a step can be successfully avoided, and that the New York money market is sufficiently strong to be able to continue its present rates.

These considerations have a good deal of influence upon the investment markets; but, so far as the electrical sections are concerned, the tale is one of steadiness and strength. Most of the shares in the London electricity supply group have now gone ex dividend. In the majority of cases a movement has been made towards the recovery of the amounts taken from the prices last Thursday. Keen interest is shown in the proceedings of the House of Commons Committee which is considering the Bill promoted by the London Electricity Joint Committee, representing 10 electricity supply companies, to set up a joint London authority and to secure powers for the generation and supply of electricity in bulk. Upon the findings of this Committee it is assumed that the final passage of the Bill, of both Bills in fact, depends when they come before Parliament for their final reading. The strong tendency shown by prices in the share market is evidence of the confidence felt by proprietors of electricity supply shares in the way their industry is being directed.

Improvements are shown, allowing for dividend deductions, in County of London ordinary and preference, Metropolitans, Notting Hill preference, as well as in Edmundsons, Urban Electric Supply Corporation, Newcastle-on-Tyne, and Clyde Valley. City of London ordinary show a slight decline at 48s., and Westminsters have eased off to 10¼. Bournemouth and Poole retain their price at 2 13/16ths. The company's report shows that the allocations are better than those of last year, and the company's reserves stand at £345,600. The company is doing well, and is making vigorous strides.

Most of the provincial undertakings are going ahead, and the natural question arises as to whether the Government could not make some definite announcement as to how these companies shall be dealt with in the matter of their tenure of life. The Parliamentary Secretary of the Ministry of Transport recently said in the House of Commons that a lot of undertakings are not really going ahead in the way they should, because they do not know whether they are going to be taken over or not. There you have, he added, a cause which really puts development into a state of stagnation. The matter is referred to in the latest return by the Electricity Commissioners, and perhaps it may be taken in hand when Parliament has finished with the affairs of the London undertakings.

Home Railway stocks are dull and heavy. The market received a further cold douche by reason of the closing-down of various blast furnaces, &c., in the North of England. This brought in a good deal of quiet selling, and the whole of the list became sympathetically affected. The only shares to stand out against the depression are those of the Underground Electric Railways, where the ordinary are ¼ up, and the 1s. shares at 8s. show a rise of 6d. On the other hand, the Income Bonds have receded to 97, Metropolitans to 78½, and Districts to 49.

Cable stocks are steady. Except for a rise to 176¼ in Eastern Ordinary, there is no special change in this particular group. Great Northerns strengthened to 32; Westerns at 17¼ are ex dividend. The Marconi group is humdrum, with little business doing, interest having dwindled to a low ebb. Radio Corporations are 10 13/16ths, the preferred 10¼. Commercial Cable 4 per cent. debenture stock is offered at 74¼, free of Government stamp and fee. The security is thoroughly well-covered, the yield on the money comes to £5 7s. per cent., and the interest is payable quarterly. A block of the stock came on the market from the company's treasury, and the greater part of it has been already placed in the hands of permanent investment.

Foreign transport descriptions are mostly weak. Mexican matters give no sign of mending. Brazilians are held down by the vagaries of the Rio exchange. The sellers of British Columbia Railway stocks do not seem to have completed their operations yet. Nor is the London group in any better case. The latest batch of reports has left its mark upon the enterprise of those people who have been hitherto in the habit of picking up the issues when prices go flat.

Electric Supply Corporation shares, as already mentioned, have improved, and show a gain of 3s. 3d. at 31s. 3d. India Rubbers put on a few pence at 19s. 6d. British Aluminium at 33s. 3d. are 2s. 6d. better. Engineering shares are steady, but the iron and steel list is heavy, the trade indications being regarded as the reverse to promising. Rubber shares are better, on a rise to 1s. 8½d. in the raw material. This is attracting more attention than business, but prices move in the right direction for holders of the shares.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom. £	Dividend. 1923.	Dividend. 1924.	Price Mar. 20. 1925.	Rise or fall.	Yield. p.c.
Bournemouth and Poole ...	1	13	14	2½	—	4 19 6
Brompton Ordinary	1	10	10	1¾	—	*5 6 8
Charing Cross Ordinary	1	14½	15	45/-xd	—	6 13 4
do. do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	12	37/6	—	6 8 0
City of London	1	15	15	48/6	—6d.	6 3 6
do. do. 6% Pref. ...	1	6	6	23/6	—	5 2 9
Clyde Valley	1	8	8	32/6	+6d.	4 18 6
County of London	1	15	15	55/-xd	+1/6	5 6 6
do. do. 6% Pref. ...	1	6	6	23/-xd	+6d.	5 4 4
Edmundson's Ordinary	1	7	—	23/-	+1/6	6 1 9
do. 7% Pref.	1	6	—	23/-	—	6 1 9
Elec. Supply Corporation ...		10	10	31/3	+3/3	6 8 0
Kensington Ordinary	5	14	15	11¾xd	+10/-	6 7 8
Lancs. Light and Power ...	1	7½	7½	27/6	+6d.	5 9 1
London Electric	1	10	10	37/6	+6d.	5 6 8
do. do. 6% Pref. ...	5	6	6	5½	—	5 9 1
Metropolitan	1	10	11	38/3xd	+6d	5 15 6
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6½	6	23/3	—	5 3 3
Newcastle-on-Tyne Ordinary ...	1	6	7	25/-	+1/3	5 12 0
do. 5% Pref. ...	1	5	5	18/9	—	5 6 8
do. 7% Pref. ...	1	7	7	25/6	+9d.	5 9 10
Notting Hill 6% Pref.	10	6	6	10	+ ¼	6 0 0
North Met. Elec. 6% Pref. ...	1	6	6	1¼	—	5 6 8
St. James' and Pall Mall ...	5	17½	17½	13	—	6 14 7
South London	1	15	15	2⅞	—	5 17 0
South Metropolitan Pref. ...		7	7	1½	—	5 13 0
Urban Ordinary	1	4	—	1⅛	+ ⅛	3 15 4
do. 6% Pref. ...	1	6	—	20/6	+6d.	5 17 1
Westminster Ordinary	5	15	15	10½	— ½	7 2 10
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	19/9 xd	+3d.	7 12 11
Yorkshire Elec.	1	8	8	29/6	+6d.	5 8 6

Home Rails.

Central London Ord. Assented	Stock	4	4	70	—1	5 14 4
Metropolitan	,,	4	5	78½	—1	6 7 5
do. District	,,	3½	3½	49	— ½	7 2 10
Underground Electric Ordinary	10	Nil	Nil	2⅞	+ ⅛	Nil
do. do. "A" ...	1/-	Nil	Nil	8/-	+6d.	Nil
do. do. Income	Bonds	6	6	97	—1	*6 3 9

Telegraphs and Telephones.

		Dividend. 1922.	Dividend. 1923.			
Anglo-Am. Tel. Pref.	Stock	6	6	105	—	5 14 3
do. Def.	,,	1½	1½	24	—	6 5 0
Automatic Telephone	1	Nil	3	1¾	—	3 8 7
Chili Telephone	5	6	6	5⅞	—	*5 7 10
Cuba Sub. Ord.	10	7	7	7¼	—	9 13 2
Eastern Extension	10	10	10	17¼	—	*5 12 8
Eastern Tel. Ord.	Stock	10	10	176½	+1	*5 13 4
Globe Tel. and T. Ord.	10	10	10	18xd	+ ¼	*5 11 1
do. do. Pref.	10	6	6	11½xd	+ ¼	5 7 10
Great Northern Tel.	10	24	22	32	+ ¼	6 17 6
Indo-European	25	7	7	22½	—	*5 6 1
Marconi	1	15	10	1¾	—	5 14 6
Marconi Marine	1	10	10	1¾	—	8 17 10
Oriental Telephone Ord. ...	1	12	12	2½	— ¼	*5 12 11
United R. Plate Tel.	5	8	8	7	+ ⅛	*5 13 0
Western Telegraph	10	10	10	17½xd	—	*5 15 11

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	12½	5½	2⅝	—	8 9 3
do. do. 2nd Pref. ...	5	5½	6	3	—	10 0 0
do. do. 5% Deb. ...	Stock	5	5	75½	—	6 12 6
British Electric Traction Ord. ...	,,	5	5	101½	—	5 18 3
do. do. 6% Pref. ...	,,	6	6	103½	—1	5 18 9
Brazil Traction	100	4	4	55½	—1	7 4 3
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	90½	—1	5 10 6
do. do. Preferred	,,	5	90/-	90½	—1	*5 5 3
do. do. Deferred	,,	8	129/6	108½	—	*5 19 3
do. do. Deb.	,,	4½	4½	79½xd	+ ½	5 6 11
Lond. & Sub. Trac. 5% Pref. ...	1	5	2½	5/6	—	Nil
London United Tram. Deb. ...	Stock	4	4	49½	—	8 1 7
Mexico Trams, 5% Bonds ...	—	Nil	5	70	—1	7 2 10
Mexican Light Common ...	100	Nil	Nil	25	—	Nil
do. Pref.	100	Nil	Nil	62½	—	Nil
do. 1st Bonds ...	—	5	5	69½	—	7 3 11
Yorkshire (West Riding) ...	1	—	5	1	—	5 0 0

Manufacturing Companies.

Babcock & Wilcox	1	20	12	66/3	—	*4 5 8
British Aluminium Ord.	1	5	5	33/3	+2/6	3 0 2
British Elec. Transformer Pref.	1	Nil	Nil	17/6	—	... ...
British Insulated Ord.	1	15	15	3¾	—	4 16 0
Brush Ord.	1	10	10	26/3	—	7 12 4
Callenders	1	15	15	8¼	—	4 12 4
do. 6½% Pref.	1	6½	6½	22/9	—	5 9 5
Crompton Ord.	1	5	Nil	¾	—	... ...
Edison-Swan	4/-	7½	10	7/9	—	5 3 3
do. 5% Deb.	Stock	5	5	81½	—	6 0 8
Electric Construction	1	10	10	32/6	—	6 3 1
Enfield Cable, Pref.	1	7½	7½	1½	—	6 0 0
English Electric	1	8	5	20/-	—	5 0 0
do. do. Pref.	1	6	6	21/-xd	—	5 14 3
Gen. Elec. Pref.	1	6½	6½	23/6	—6d.	5 10 8
do. Ord.	1	5	5	22/-	+3d.	4 16 11
Henley	1	15	15	3⅞	— ⅛	4 14 1
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	10	5	19/6	+3d.	*5 2 7
Johnson & Phillips	1	5	5	1⅞	—	4 0
Met-Vickers, Ord.	1	12½	8	24/6	—6d.	6 10 8
do. Pref.	2	8	8	2½	—	6 8 0
Siemens Ord.	1	5	—	20/6	—	3 15 6
Telegraph Construction	12	20	20	27xd	—	*4 14 1

* Dividends paid free of Income Tax.

Anti-Friction Bearings for Electric Motors.

Their Design and Care.

By C. H. S. TUPHOLME.

(*Concluded from page 448.*)

Two different mountings for vertical motors are shown in fig. 5. In the right-hand diagram, as the lower bearing carries most of the radial load, the weight of the armature is carried on the upper bearing, which is of the "radio-thrust" type. While the motor is running, the oil in the cup-shaped reservoir beneath the bearing is thrown into the bearing by centrifugal action. This type of lubrication has proved very satisfactory and requires little attention. The lower bearing is mounted on a bushing pressed on the shaft, and oil is retained by the sleeve or dam pressed into the housing cap.

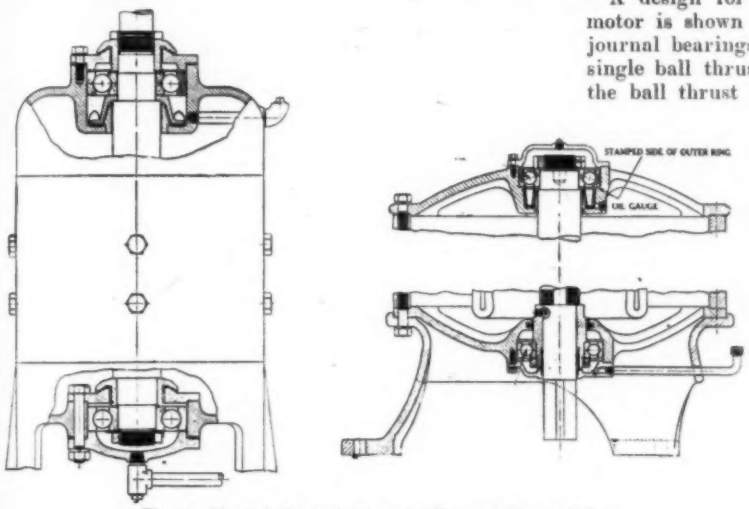


Fig. 5.—Vertical Motor Bearings for Top and Bottom Drives.

In the left-hand diagram, as the drive and therefore most of the radial load is at the top, the weight of the armature is carried on the lower bearing. The upper bearing is equipped with splash vane lubrication, and is protected from dirt by a slinger and spiral groove. The lower bearing is lubricated by maintaining the oil in the reservoir at the proper level indicated by the gauge glass.

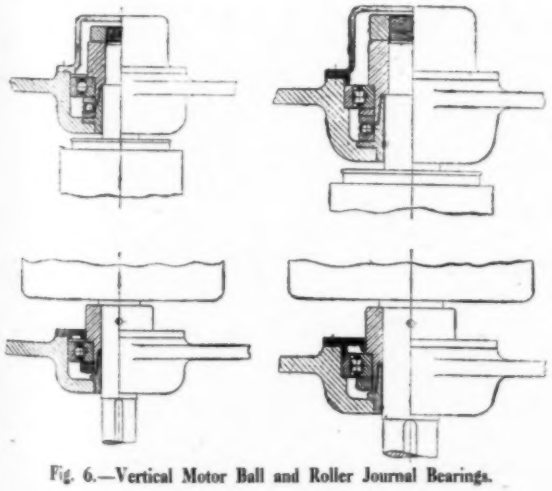


Fig. 6.—Vertical Motor Ball and Roller Journal Bearings.

On the left hand of fig. 6 is shown the application of ball bearings to a vertical electric motor of moderate horse power. In this design two ball journal bearings and a single ball thrust washer are used. The ball thrust is mounted in the upper housing, which is common practice, though, should special considerations favour the fitting of the thrust bearing in the bottom housing, this can be done in the same manner. In this design, by the use of re-entering sleeves, one fitted to the shaft and the other to the housing, it is possible to ensure a satisfactory supply of grease to the bearings without the possibility of its escaping down the shaft and causing trouble.

A design for the heavier types of vertical electric motor is shown on the right of fig. 6, in which roller journal bearings are employed in conjunction with a single ball thrust washer. As in the previous design, the ball thrust washer is usually fitted in the upper housing, though it may be installed in the lower housing if special considerations favour that course.

In these two designs it is necessary that the sleeves which provide the seatings for the bearings be true and concentric. The revolving sleeves should have a long seating on the shaft, and should be a tight fit on it. The revolving sleeve for the upper bearing is clamped against a shoulder on the shaft by means of a top nut, which is, of course, securely locked in position. The corresponding sleeve for the lower bearing is pinned to the shaft. The recesses in the housings into which the stationary sleeves fit should be bored out concentric with the seating for the outer race of the journal bearing. This is particularly important in the case of the upper bearing where the stationary sleeve is relied upon to hold the lower race of the thrust-bearing concentric with the upper. The seating for this lower race should be smooth and concentric.

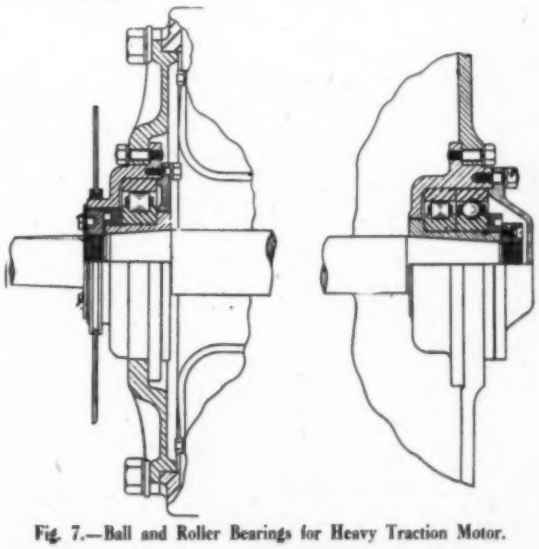


Fig. 7.—Ball and Roller Bearings for Heavy Traction Motor.

An interesting application of ball and roller bearings is shown in fig. 7, which is of Hoffmann design. This is to carry the armature of a heavy traction motor. The armature is supported on two roller journal bearings and is held on the end by means of the ball location bearing. This ball bearing is of the journal type, but

is made below size on its outside diameter to render it free radially in the housing.

The method of applying the bearings will, of course, vary with the different types of machines. In the case shown in fig. 7 the machine is of the type with a solid frame, having loose end plates. It will be seen that by loosening the bolts which hold the right-hand housing in position and those holding the left end plate, the armature can be removed complete with the bearings fully protected in their housings. These bearings are equally applicable to machines in which the carcass is split horizontally. The design of these traction motors incorporating roller bearings has eliminated all risk of the armature dropping on to the pole pieces of the motor, reduced the starting effort, and, by means of grease lubrication, has prevented electrical trouble from oil leakage.

In the application of ball bearings to train-lighting dynamos, the armature is often supported on two ball journal bearings, in accordance with standard practice for small electrical machines. It has, however, been found a distinct advantage to replace the ball bearing next to the pulley with one of the roller type, thus giving a larger margin to deal with the extra load from the driving belt. Anti-friction bearings have been adopted extensively on machinery of this type, and show to great advantage, as such machines must be capable of service under severe conditions and for long periods without failure.

The intensity of pressure at the point of contact of a ball and its race, or the line of contact in the case of a roller, is so heavy that lubrication in the sense that the surfaces must be kept apart is impossible. There is no known lubricant which will keep the balls and rollers and their races apart, nor should this be necessary in a properly-designed bearing where there is true rolling without rubbing or slipping. The manufacturers of anti-friction bearings have given considerable thought to the finishing of the surfaces of the balls, rollers, and races, and the result is a high-class bearing with a surface as free from indentations and scratches as it is possible to produce on a commercial scale.

On the other hand, the fact that ball and roller bearings need very little attention often misleads users into thinking that they need no attention at all. It is, however, essential that all anti-friction bearings be lubricated to minimise wear, protect the polished surfaces of the bearings and the races against rust, and also to facilitate the axial movement of the outer rings.

The fact that the highly-polished surfaces of the bearings are particularly susceptible to corrosion means that only a lubricant should be used which is entirely free from acid or alkali; animal or vegetable greases are all liable to develop acid, attacking the ball and rolled surfaces and causing corrosion and rust.

It is also essential that the lubricant be free from grit, as the impurities of this nature in a grease are very often directly responsible for wear in bearings.

The most suitable lubricant for ball and roller bearings is a pure, neutral mineral grease of about the consistency of vaseline. This should be crammed into the bearing as soon as it is put into service, and need only be renewed after a long interval, depending upon the severity of the operating conditions. If arrangements can be made to keep the bearings flooded with oil, then this type of lubricant will be quite satisfactory, and if the speed of the machine is exceptionally high, oil lubrication is better than grease.

It is equally important to see that all anti-friction bearings are protected against the entrance of moisture and dirt. Wherever possible, the bearing should be completely enclosed.

The bearings should be inspected at regular intervals, depending upon the character of the conditions under which they are working. About a fortnight after they have first been put into service they should be examined to ascertain the state of their lubrication, and, after that, inspection should be regular, the lubricant being renewed as required, and the bearings, if necessary, being dismantled and cleaned thoroughly.

The Electrical Exports of Czecho-Slovakia.

In the Electrical Review for March 20th, a statement was published giving the quantities of electrical goods imported into Czecho-Slovakia. There is now set out below a similar statement of Czecho-Slovak exports of such goods in 1923, based on the recently issued official statistics. The corresponding figures for 1922 are added for purposes of comparison, together with notes of any increases or decreases.

	1922. Kilogrammes.	1923. Kilogrammes.	Inc. or dec.
Electric lamp bulbs—			
Total	720,000	595,000	– 125,000
To Hungary	659,000	515,000	– 144,000
Electrical insulators—			
Total	989,000	510,000	– 479,000
To Belgium	207,000	117,000	– 90,000
,, Austria	228,000	79,000	– 149,000
,, Great Britain	95,000	65,000	– 30,000
Electric dynamos and motors, transformers and converters, weighing 25 kg. or less—			
Total	8,000	2,000	– 6,000
To Germany	100	700	+ 600
,, Austria	700	600	– 100
,, Poland	100	300	+ 200
Ditto, ditto, weighing from 25 kg. to 5 quintals—			
Total	127,000	76,000	– 51,000
To Austria	65,000	27,000	– 38,000
,, Poland	15,000	19,000	+ 4,000
,, Jugo-Slavia	15,000	10,000	– 5,000
Ditto, ditto, weighing from 5 quintals to 30 quintals—			
Total	134,000	78,000	– 56,000
To Hungary	39,000	18,000	– 21,000
,, Poland	16,000	10,000	– 6,000
,, Jugo-Slavia	22,000	10,000	– 12,000
Ditto, ditto, weighing from 30 to 80 quintals—			
Total	12,000	37,000	+ 25,000
To Switzerland	—	20,000	+ 20,000
,, Austria	5,000	17,000	+ 12,000
Ditto, ditto, weighing over 80 quintals—			
Total	27,000	242,000	+ 215,000
To Germany	—	75,000	+ 75,000
,, Austria	—	65,000	+ 65,000
,, Switzerland	—	45,000	+ 45,000
,, Jugo-Slavia	—	32,000	+ 32,000
,, Hungary	24,000	21,000	– 3,000
,, Poland	3,000	—	– 3,000
Telephones, weighing under 5 kg.—			
Total	2,000	3,000	+ 1,000
Electrical measuring instruments, weighing 5 kg. or over—			
Total	3,000	1,000	– 2,000
Ditto, weighing under 5 kg.—			
Total	3,000	1,000	– 2,000
Switchgear—			
Total	44,000	10,000	– 34,000
To Brazil	—	2,500	+ 2,500
,, Poland	3,000	2,000	– 1,000
,, Belgium	9,000	—	– 9,000
,, Holland	8,000	600	– 7,400
,, Jugo-Slavia	7,000	600	– 6,400
Incandescent lamps—			
Total	119,000	210,000	+ 91,000
To United States	7,000	65,000	+ 58,000
,, Germany	85,000	33,000	– 52,000
,, Poland	—	32,000	+ 32,000
Electric lamp sockets—			
Total	16,000	6,000	– 10,000
To Austria	10,000	1,500	– 8,500
Regulators, resistances, &c.—			
Total	72,000	65,000	– 7,000
To Jugo-Slavia	13,000	39,000	+ 26,000
,, Austria	5,000	6,000	+ 1,000
Cable and insulated wire, metal covered—			
Total	102,000	82,000	– 20,000
To Belgium	4,000	45,000	+ 41,000
,, Rumania	60,000	16,000	– 44,000
,, Poland	1,000	14,000	+ 13,000
Ditto, covered with paper or asbestos—			
Total	24,000	8,000	– 16,000
To Bulgaria	—	3,000	+ 3,000
,, Germany	—	2,000	+ 2,000
Ditto, covered with rubber—			
Total	1,000	4,000	+ 3,000
To Rumania	—	4,000	+ 4,000

	1922. Kilogrammes.	1923. Kilogrammes.	Inc. or dec.
Ditto, covered with asbestos, paper, rubber, &c.—			
Total	190,000	261,000	+ 71,000
To Rumania	86,000	115,000	+ 29,000
„ Jugo-Slavia	41,000	80,000	+ 39,000
„ Poland	700	29,000	+ 28,300
Accumulators—			
Total	30,000	3,000	− 27,000
Electric light carbons—			
Total	200	25,000	+ 24,800
To Bulgaria	—	12,500	+ 12,500
„ Great Britain	—	12,500	+ 12,500
Electrodes—			
Total	800	41,000	+ 40,200
To Germany	—	15,000	+ 15,000
„ Holland	—	15,000	+ 15,000
„ Austria	—	11,000	+ 11,000

Electrical Progress in Spain.

IN the course of an article in a recent issue of *La Energia Electrica* on the electrical progress in Spain during 1924, it is stated that owing to the question of finance the work carried through consisted mainly of the completion of the schemes which were already in hand at the beginning of the year. As regards hydro-electric progress, apart from three small plants of less than 100 h.p. each in the province of Guipuzcoa, the only important installation completed during the year was the Penas de Castro station at Extremera; this is of 2,000 h.p. and utilises the water power of the River Tajo. The current generated is transmitted to Vicalvaro for use in a cement factory. Good progress is being made with the establishment of a 15,000-h.p. plant at Villalba de la Sierra for the Sociedad Hidro-electrica de Castilla and one of 16,000 h.p. to utilise the power of the Tamba falls for the Sociedad Gallega de Electricidad. The Sociedad Hidro-Electrica del Cantabrice, which utilises the Somedo falls, is increasing the capacity of its plant from 8,000 to 16,000 h.p. The concerns known as the Productores de Fuerzas Motrice and the Co-operativa de Fluido Electrico, of Barcelona, are also increasing their capacity. The Sociedad Hidro-Electrica Espanola has increased the capacity of its plant in Madrid from 12,000 to 20,000 h.p. and has also secured the rights to utilise the Franco de Lobo falls (3,000 kW) at Durcal.

There is an increasing tendency to establish reserve steam or Diesel-engine stations in connection with hydro-electric undertakings. Thus the Central del Pacifico has put in three 1,500-h.p. Diesel engines in order to be in a position to maintain a constant supply of current to the Madrid underground electric railway. The Sociedad Electricas Reunidas de Zaragoza has also installed three Diesel engines and alternators of a total capacity of 3,000 h.p. and has completed a 10,350-kVA transformer station. The Sociedad Electrica de Viesgo, which owns six hydro-electric stations in the provinces of Asturias and Palencia and has already a reserve plant of 2,500 h.p. at Santander, has installed an additional one near the Espanola collieries; the capacity is at present 1,500 h.p., but the station has been designed for an eventual extension to 4,000 h.p. Finally it may be mentioned that the Sociedad de Fuerzas y Riegos del Ebro, of Barcelona, has now completed its constructional programme, the aggregate capacity of its various plants being no less than 146,500 h.p.

In the electric traction department the principal feature of the year was the completion of the electrification of what is known as the Pajares ramp on the Madrid-Gijon railway, which has an average gradient of 22 per cent. Twenty-two trains of an average weight of 330 tons are being run in each direction per day, the ascending speed being nearly 22 m.p.h. and the descending speed from 28 to 37½ m.p.h. The line is worked with 3,000-V direct current and the electric locomotives are of 270 h.p. and weigh about 78 tons each. The necessary current is supplied by the Sociedad Electrica de Viesgo, the current being transmitted at 30,000-V a.c. to a transformer station at Campomanes, where it is stepped down and converted. The electrification work, which is regarded as the most important so far completed in Spain, was carried out by the Sociedad Iberica de Construcciones Electricas. During the year the Sol-Venta section of 2¾ miles of the Metropolitan railway in Madrid and the first section, 1¼ miles, of the Barcelona underground electric railway, were completed. Contracts for a sub-station and rolling stock for the electrified portion of the Urola railway between Zumarrago and Zumaya, were given out and work commenced on the laying of the cables for the Trans-Pyrenean railway between Ripoli and Aix-les-Thermes. Among the new electric tramway work completed was the Padul-Durcal section, 3¾ miles, of the Compania de Tranvias Suburbanos de Granada; a 5-mile extension of the Pontevedra tramways to Lerez and Marin; and a 3¾-mile extension to Camas of the Seville tramways.

The Electrical Trade Position in Brazil.

WE commented editorially in our last issue (p. 441) upon a report recently published with reference to British electrical inactivity in Rio Grande do Sul. We have now received the following notes on the situation in Brazil from our special South American correspondent:—

"Brazil is proving a profitable field for electrical enterprise, several large contracts having recently been entered into now that more peaceful political conditions seem likely to prevail. Owing to the increase of German quotations for most electrical lines, which have advanced from 10 to 15 per cent., fewer contracts are now being given to Teutonic houses; indeed, larger business is being booked by both British and United States agents. The monthly imports of electrical equipment into Brazil have averaged between 300 and 400 metric tons (430-460 cases). Of 432 cases recently received, 234 (15 metric tons) came from the United Kingdom; 139 cases (153 metric tons) from the United States; 30 cases (94 metric tons) from Germany, and 10 cases (20 metric tons) from Italy. It is reported that a number of German electrical manufacturers are supplying stocks to British firms in Brazil on consignment, such stocks being delivered to the distributors at factory cost, free of charge, and, when sold, the profits are equally divided between the manufacturer and the dealer. All books and reports are open to the investigation of both parties, who employ an auditor appointed by mutual consent."

We may also quote some statements, bearing upon the electrical position in Brazil, made by the French Chamber of Commerce at Rio de Janeiro. According to this report there is a sale in Brazil for electric generators of many capacities, especially 3-phase 50 to 60 cycles, as well as transformers; insulated wires and cables of all ordinary types and sections, provided they are in accordance with American specifications; installation material for both interior and exterior, factory and house; and lamps of all types and candle power provided they are fitted with Edison screw holders and not bayonet type. Electrical manufacture in Brazil is in its infancy, but there are works turning out small motors, armature wire and insulated wire, as well as insulators. In Rio there is a firm making machines of from 10 to 15 h.p., but its production only amounts to a few motors daily. There is also a concern in Rio buying old dynamo wire locally and renovating it. Sao Paulo, which is a great industrial centre, possesses large works which import copper ingots and transform them into wire, which is then covered with cotton and rubber. All dimensions of wire are made. At present the establishment is experimenting in the production of armoured cable. A number of works in Brazil are engaged in making insulators, but have not yet attained much success in high-tension work.

For all the business which is being offered in electrical material, there is very active competition on the part of foreign manufacturers. In spite of difficulties in connection with the exchange rates, imports continue on a satisfactory level, and are likely to increase in proportion to the development of the country's rich natural resources. Most of the import trade is in the hands of large firms with very extensive fields of sale. The tramway and railway companies are for the most part their own importers, and usually obtain their material free of Customs duty. The same remarks apply to the electric lighting companies.

Latin American Electrical Notes.

(From Our Own Correspondent.)

THE electric light service recently constructed in the Republic of El Salvador for the purposes of lighting the towns of Santa Tomás, San Marcos and Santo Tezacuangos, has been completed and opened to public use.

A new company has been formed in Venezuela under the title of the Compañia Anónima Venezolana de Luz, to provide the capital, Caracas, with electric light. It was proposed to order from Europe, if the tenders were acceptable, the whole of the plant and large dynamos, but already strong competition upon the part of United States manufacturers is being encountered. In the same Republic, Congress has approved a contract for a telephone service for the city of Maracaibo and towns adjacent in the district of the same name, all situated in the State of Zulía.

A newly-formed Chilean company (Compañia Electro Siderurgica e Industrial de Valdivia) is about to erect a large electric blast-furnace, utilising a waterfall 307 metres in height on the Hui River, for the generation of the necessary electricity. The power-plant will have a capacity of 120,000 h.p. and will be located at Huilo-Huilo, situated 105 km. from the town of Valdívia. The furnaces, to be erected after the electric installation has been completed, will be capable of producing annually 30,000 tons of sheet steel and other products. Inasmuch as the greater part of the commerce of Valdívia is in the hands of Germans, it is highly probable that the whole of the machinery and plant will be ordered from Germany.

Electrical Sales in Chile.

A French Investigation.

The market for electrical goods in Chile is surveyed in a recent issue of the *Moniteur Officiel du Commerce*, of Paris, the organ of the French Ministry of Commerce. Prospects for the sale of French apparatus are not considered good because the French makers do not follow the specifications required in Chile. This disability applies also to wires and cables, German standards having been adopted by the local authorities. Consequently France takes quite an insignificant part in the trade generally. It is pointed out that the market is large for generators, both a.c. and d.c., and for motors, but that the Germans supply the larger machines, chiefly on account of their extensive connections and many technical men in the country. Transformers of small capacity only are in demand. There is a ready sale for cables, but the standard insulated wire is that known in Germany under the name of "G.A." Competition for the lamp trade is very active, most of the well-known makers keeping large stocks in the hands of their agents. The Edison-screw lampholder is used, not the bayonet type. There are no lamp factories in Chile.

For several reasons the writer in the *Moniteur* foresees that the Chilean market for electrical goods will expand continuously in the future. Powerful central stations utilising the waterfalls of the Cordilleras have been built in order to supply power to the electrified railways, but there is a considerable reserve for use not only in improving the lighting and traction services of Santiago, but also in furnishing power to the factories which are being established beneath the shelter of protective import duties.

It is intended to electrify all the Chilean railways. New power stations utilising more of the water power of the Cordilleras are projected in Southern Chile, where there are many rich and prosperous zones of great promise. In order to obtain a share of the new business that will ultimately result from these developments, manufacturers are recommended to engage the services of a good agent and to place on the market apparatus that conforms either to German or American standards. The usual procedure followed in the trade is to send goods on consignment to the big electrical firms in Chile, payments being made either on sale or by long-term drafts. These for the most part are drawn at 30, 60, or 90 days sight, or longer, against shipping documents (bill of lading, Consular invoice and insurance policy). Acceptances are taken care of by the Bank, to which the goods are consigned by the exporter. Invoices should be drawn up to include transport, freight, insurance, bankers' interest, commission, &c., so that the draft may cover the exact sum and thus obviate any future claim. The bank should be supplied with a copy of the invoice, which should, of course, correspond with the amount of the draft. In Chile bills are not customarily accepted until the actual arrival in port of the vessel by which the goods have been consigned.

The Shannon Power Scheme.

The Experts' Report.

The report of the four Continental experts on the scheme prepared by Messrs. Siemens-Schuckertwerke for utilising the water power of the River Shannon has now been issued. The complete scheme is divided into three stages, of which the first only is of immediate interest. For much of what follows we are indebted to the *Irish Times*.

The scheme contemplates the utilisation of the whole of the fall between Lough Derg and Limerick—about 100 ft. head, the power house being situated at Ardnacrusha, near Limerick. The weir at Killaloe will be removed, and the level of the water will be raised by a weir near O'Brien's Bridge to that of Lough Derg, a height of 23 ft., necessitating the construction of embankments 25 to 30 ft. high. The river will also be deepened at Killaloe by dredging. The head race, 6¼ miles long, from O'Brien's Bridge to Ardnacrusha, will be 300 ft. wide and 30 ft. deep; 5,000,000 cubic metres of earth and 500,000 m³ of rock will have to be excavated, by bucket-dredgers and conveyors. The Shannon will also have to be deepened for the tail race, by the removal of 500,000 m³ of rock. In the first stage Lough Derg will be used only for storage, not raising its present maximum level but maintaining it longer. Flooding of agricultural land will be stopped by embankments, and surplus water behind them will be removed by electric pumps; about 5,000 acres will be laid dry. In the later developments, Loughs Rea and Allen will be utilised, and the necessary embankments will prevent flooding over a further 7,000 acres. Navigation will be facilitated by the provision of a ship's hoist designed for 150-ton boats between the tail race and head race.

The Siemens report states the average flow of the Shannon as 244 m³ per second; in the first stage 81 m³/sec. will be utilised, driving three vertical Francis turbines of 30,000 h.p. each, at 150 r.p.m. In the complete development this installation will be doubled. The pipe line will be 20 ft. in diameter. The generators will be rated at 30,000 kVA, 10,500 volts, 50 cycles; the pressure will be transformed up to 100,000 volts for transmission to Dublin and Cork, and to 35,000 volts for the secondary distribution lines, carried on steel towers. Subsidiary lines will be supported by wooden poles and work at 10,000 volts. Pole transformers will be widely used.

The cost of the partial scheme is estimated at £5,200,000, and of the complete scheme £7,188,000. The cost of energy delivered at Dublin is put at 0.53d. per kWh; in towns of over 5,000 population, 0.74d.; and in smaller places, 0.84d. The annual output with the partial scheme is estimated at 150 million kWh. It is expected that 3,000 men will be employed for three years, of whom 500 will be semi-skilled; a small number of German engineers will be in charge of the work, but about 50 Irish engineers will be required. If the State undertakes the scheme the German firm will receive the contract for materials and construction; if the State does not take it up the company may do so, and if the necessary financial support is not forthcoming it will be paid £10,000 for expenses in preparing the report. If the company does not attempt to carry out the scheme it will receive only £5,000.

The experts appointed to examine the scheme were Messrs. Waldemar Borgquist (Stockholm), T. N. Schulz (Oslo), Rohn, and Meyer-Peter (Zurich); their report generally corroborates Messrs. Siemens-Schuckert's conclusions, but suggests important modifications, some of which have been adopted by the company. They state that in the Free State the annual consumption of electricity is about 20 kWh per head, but that in a few years, after a supply becomes available, it will be 50 kWh, requiring a total output of 150 million kWh a year, and that further development will become necessary shortly after the first stage is at work, as the demand for electrical energy only begins to increase when the energy is available. The flow of the Shannon is greatest in winter and least in summer, an "extraordinarily favourable" characteristic. Land at present liable to flood will be protected, and only 2,050 acres will be submerged by the raising of the lakes. The Government is recommended to carry out an improvement scheme in conjunction with the protection of areas liable to flood.

The experts endorse the proposal of the company to utilise the whole head in one step. Much of the report relates to the improvement of navigation.

Messrs. Siemens-Schuckert give the following statement of costs:—

	Partial Development.	Full Development.
Power plant	£2,740,000	£4,224,000
100,000-V lines	284,000	284,000
100,000-V transformer stations	88,000	151,000
35,000-V lines	751,000	786,000
35,000-V sub-stations	156,000	204,000
10,000-V lines	178,000	331,000
10,000-V sub-stations	35,000	64,000
Total	£4,232,000	£6,044,000
Compensation for improvements, *deduct*		200,000
		£5,844,000
15 per cent. interest during construction	635,000	877,000
Total	£4,867,000	£6,721,000

The experts state that it is "beyond all doubt that the Shannon works could deliver energy at a cheaper rate than local plants"; moreover the cost would decrease as the initial costs were written off. The rate of interest is taken at 5.5 per cent., and full amortisation in 40 years is provided for.

The annual revenue is estimated as follows:—

	Partial Development.	Full Development.
Towns and rural districts ...	£382,000	£727,000
Sale of heating energy ...	23,000	35,000
Total	£405,000	£762,000
Expenses	486,000	671,000
Loss or gain	−81,000	+91,000

It is stated that in about five years the undertaking should return about 5.5 per cent. on the invested capital, increasing up to 7 per cent. The consumption of electricity, by the date of opening of the first instalment of the plant, is estimated at 126 kWh per head per annum in the cities, eventually rising to 174 kWh. The cost of reaching the whole of the population would be excessive; it is assumed that in the partial development only 10 per cent., and in the complete development 30 per cent., would be supplied. Agriculture in Ireland is mainly pastoral, so that the use of power in the rural areas is limited to fodder cutting, pumping, &c. There are 500 creameries, of which up to 40 per cent. may eventually be electrically driven. The erection of an electrochemical factory for the manufacture of artificial manures has been considered, but is not recommended. The experts hold that the rural population will readily adopt the use of electricity, and that the output of the Shannon works will be absorbed much earlier than is generally expected at present.

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

A New Crystal Detector.

The trouble and uncertain operation which result from the employment of a detector that depends for its sensitivity upon critical adjustment can be avoided entirely by the use of the P.M. detector recently placed on the market by Radio Instruments, Ltd. This excellent rectifier, which we have tried and can recommend, has a fairly high resistance, is stable, and distinct from all existing types. It is said to be permanent in the true sense, and is quite unaffected by vibration. One of the minerals employed has a very high refractory index, and has been subjected to careful experiment and observation for many months. No cat's whisker of any kind is employed, but, instead, a small selected piece of the special mineral is mounted in a metal cup held in Wood's metal, and contact for rectifying purposes is made with another mineral, either bornite or tellurium.

In the original form in which this detector was made no means of adjustment was provided; however, having been advised that it would be an advantage to construct the component in such a way that the point of contact between the crystals could be readjusted if necessary, the makers have, in the final design, fitted one of the elements on a spring plunger so that a trigger action is obtained by the mere pulling of a small ebonite knob, which withdraws the minerals from contact with each other. Contact can be re-established in a different position as desired without searching for any sensitive spots, as the plunger has merely to be released after rotation, the contact surfaces of both crystals being uniformly sensitive. Normally, of course, it is not necessary to interfere with the contact at all and, if desired, the detectors can be supplied in a sealed form without the means of adjustment.

One of the principal advantages of the new R.I. detector becomes evident when it is used in combination with reflex valve circuits, as it appears to overcome the difficulty with which users of these circuits have had to contend owing to instability of the crystal contact. In addition, it will open up a new field for the users of crystal sets, which will now require no adjustment whatever and, therefore, no skill in operating.

Some New "Cosmos" Valves.

The latest patterns of valves of which we have received samples from Metro-Vick Supplies, Ltd., are fitted with black Bakelite low-capacity caps and standard 4-pin plugs. The most interesting is the S.P.18 "Shortpath" type, which is of quite novel construction. The coated filament has a core of platinum-iridium, much less brittle than platinum, the glow being barely visible in bright daylight. Fig. 1 illustrates the valve, which is 4¼ in. in overall length (including pins) and 1 in. in diameter; figs. 2, 3 and 4 indicate the unusual design of the electrodes. The anode, fig. 3, is of the flattened form now general in modern construction, but the straight filament is located to one side of the plate, and is kept in

Fig. 1.—"Cosmos" "Shortpath" Valve.

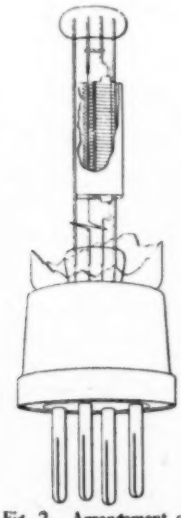


Fig. 2.—Arrangement of Electrodes.

Fig. 3.—S.P.18. Anode.

tension by a spring arrangement that always maintains the same alignment. It is surrounded by a cylindrical grid, fig. 4, each coil of which is lashed with wire to a channelled support, as shown. Thus the grid can be made of very fine wire, placed close to the filament, without risk of contact; the unusual rigidity of the framework prevents relative movement between the electrodes, the whole system being braced at both top and bottom by the glass bridge piece, fig. 4.

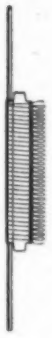


Fig. 4.—S.P.18 Grid.

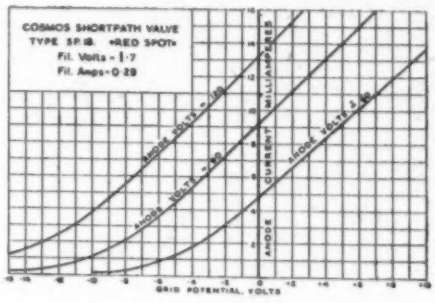


Fig. 5.—"Shortpath" Characteristic Curves.

The resulting stiffness enables the distances between the electrodes to be made very small with attendant advantages.

Fig. 6.—"Cosmos" D.E.11 Valve.

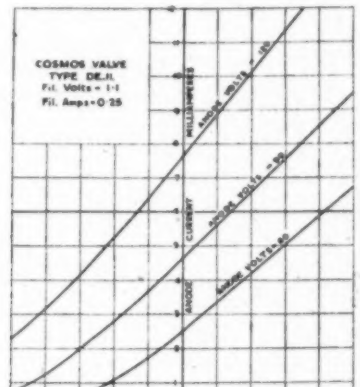


Fig. 7.—D.E.11 Characteristic Curves.

The short path reduces the effect of the space charge round the filament, increasing the anode current with a given anode voltage; the internal resistance, and consequent loss of energy,

Fig. 8.—The A.45 Bright Filament Valve.

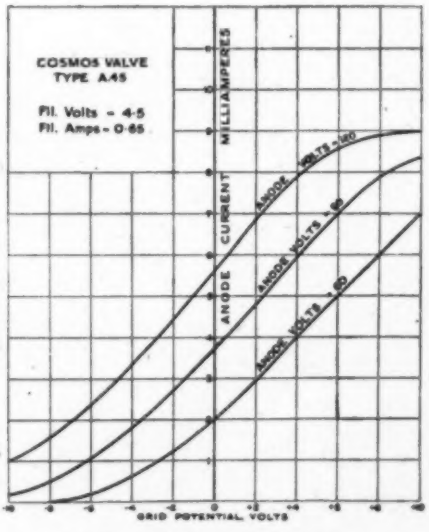


Fig. 9.—A.45 Characteristic Curves.

is reduced so that the efficiency of the valve is high. The filament voltage is from 1.7 to 1.8 V and its current 0.3 A; the plate voltage when amplifying is from 20 to 120 V, the anode impedance is from 7,000 to 8,000 ohms, the voltage

amplification factor 7.0, and the slope of the characteristic curve from 0.9 to 1.0 mA per volt. The grid current has an exceptionally sharp bend, and is very steep, with consequent efficient rectification; the characteristic curve, fig. 5, has a long straight portion, and it should be noted that the grid current does not commence to flow until the grid voltage is about 2 volts positive to the filament. Hence a large swing of grid voltage is possible without getting on to the bend of the curve, or starting grid current, which facts make the S.P.18 valve particularly suitable for l.f. amplification purposes. For detecting or h.f. work the plate potential may be from 20 to 60 V, and in view of the grid current being late in starting it is essential that the grid leak be connected to the positive filament lead when the valve is to function as a detector. This valve can be recommended as a really good all-round type; it needs much less reactance than ordinary patterns, and its capacity to handle an appreciable amount of power makes it effective as a last stage.

Another "Cosmos" valve is the D.E.11 general purpose dull-emitter for use with dry batteries. Its electrodes are mounted in the usual cylindrical manner, but its filament is much more robust than those taking a smaller current at a higher voltage. The overall length of the valve, fig. 6, is 3¼ in., and its diameter about 1 in. The filament voltage is 1.1 V and current 0.25 A; the anode voltage when detecting is from 20 to 45 V, and when amplifying from 40 to 100 V. The anode impedance is 18,000 ohms, the voltage amplification constant 6.5, and that the straight portion of the characteristic curve extends well to the left of the zero grid-voltage line is shown by fig. 7.

The "Cosmos" A45 is a bright filament valve, fig. 8, 4¼ in. in overall length and 1¼ in. in diameter. Its characteristic is indicated by fig. 9, the filament voltage being 4.5 V and current 0.65 A; as a detector it needs from 30 to 60 V anode voltage, and up to 120 V when amplifying. The anode impedance is 20,000 ohms, voltage amplification factor 9, and the slope of the characteristic curve 0.45 mA per volt. All the types referred to above have clear glass bulbs, and are therefore free from the stray capacity effects which are apt to be associated with the dense conductive deposit produced by the "getter" on the inside surface of the glass recently fashionable.

Permanent Magnets in Theory and Practice.

Metallurgy and Manufacture.

By S. EVERSHED, M.I.E.E.

(*Résumé of paper read before the* Institution of Electrical Engineers.)

This is a second paper on the same subject.* The original intention of describing modern magnet-making practice in a second paper, with enough metallurgical explanation to render the various processes intelligible, was abandoned when it was discovered that current metallurgical science had nothing to say about those matters which are of most consequence to the magnet maker. Perplexities begin with the steel itself as it comes from the steelworks, and the author found it necessary to enter an almost untrodden metallurgical field; to study spoiled magnet steel and its restoration; to determine the relation between the carbon content and the coercive force of hardened tungsten steel; to investigate the harmful magnetic effect of ultra-heating; and, lastly, to measure the slow decay of hardened steel.

The outcome of prolonged research on these and kindred subjects is included in Part III, which treats the metallurgy of magnet steel as a material for permanent magnets, and is founded on the hypothesis that the potency of steel arises from the molecular pattern created by the solution of carbon compounds in magnetic iron. A strictly logical sequence in so intricate a subject is out of the question, but for greater ease of reading the various matters to be dealt with are presented, so far as possible, in their natural order. No attempt has been made to adhere to conventional metallurgical ideas or phraseology. The metallurgical reader may possibly feel lost without his pearlite, his austenite, and his phase rule, but a little fresh air does no one any harm.

Part IV opens with a general account of the manufacture of permanent magnets, attention being mainly directed to matters in which common practice stands in need of amendment. It is shown that the most favourable composition for magnet steel can be determined once for all from measurements of available magnetic energy, the optimum composition of tungsten magnet steel having already been ascertained by that means.

The section in Part IV under the heading "Cast Magnets" contains an account of research conducted by the British Scientific Instrument Research Association, and completed some three years since. It was found possible to cast permanent magnets in either tungsten or cobalt steel, and the cast magnets, while presenting many advantages over the customary magnets of rolled steel, were in no way inferior to them in magnetic power.

Throughout the paper, and notably in bringing Part IV to a conclusion, the author has freely introduced ideas of a speculative kind, in the hope that trains of thought may be set going in other minds in altogether novel directions.

With the treatment which imparts stability to the oriented magnetic molecules, the making of the magnet comes to an end. The previous paper began by presenting a picture of the magnetic mechanism, and now in taking a final view attention has once more been riveted on the magnetic molecules and the fragile nature of the means by which they hold themselves together as an oriented system of magneto-motive forces. Apparently, the weaving of the elaborate molecular pattern is a simple business, which steel and magnet makers, between them, have long succeeded in doing in a rough and ready fashion; until recent years they managed to accomplish the feat with their eyes shut, but their success has been very largely a matter of luck.

Nowadays there is no great difficulty in melting scrap steel and improving it with a handful of ferro-tungsten and a pinch of carbon; in casting the molten metal, in hardening it and, finally, in magnetising it. The product is bound to be a permanent magnet of some sort, good or bad, but the manufacture of uniformly powerful magnets is a very different problem, and it would be hard to find any similar industry so full of pitfalls. At every stage from the molten metal to the final treatment for magnetic stability, difficulties crop up one after the other.

The trouble begins in the mixing of the ingredients of magnet steel, uniformity of carbon content being apparently difficult to achieve in practice, but the optimum composition of tungsten magnet steel has now been determined, and it may be hoped that some well-equipped research laboratory will undertake the much more difficult task of determining the optimum composition of cobalt magnet steel. The general use of optimum compositions should leave the steelmaker free to concentrate his efforts on uniformity of composition, more particularly with regard to carbon content. The day for tinkering with the proportions, a little more of this ingredient, a little less of that, is definitely over.

Spoiling the steel by decomposition is the next trouble, and a serious one, but the production of spoiled steel can be prevented and the necessary modifications in steelworks practice will no doubt be made. Reluctance to give up old ways may delay the change; but not for long, when magnet makers begin to be unwilling to buy decomposed steel. Cast magnets are almost unspoiled, and their introduction will accustom the magnet maker to something better than badly spoiled rolled steel.

Ultraheating is manifestly quite unavoidable, but ultra-heated magnet steel is a trap for the unwary magnet maker rather than a serious difficulty. It is easy to restore it to the normal or all-alpha state.

The hardening of steel for use as permanent magnets presents several drawbacks, cracking and distortion among them, but as a means of securing the solution of enough carbon to give the necessary degree of potency, hardening is at present indispensable. What it does, in effect, is to prevent the carbide molecules from leaving their solution positions when the allotropic change from beta to alpha iron takes place. The carbide molecules are "frozen" in their solution positions by the sudden lowering of the temperature of the metal to a point at which very little molecular mobility remains. Temporarily, at all events, this method of compelling more carbide molecules to remain in solution than the solvent alpha iron naturally holds is entirely successful.

But molecular mobility at ordinary room temperatures, although very slight, is not zero. Little by little the carbide, artificially retained in solution, passes from solution to crystal. Year by year the potency decays. Whether decay will ultimately stop at some point short of the passage of the whole of the surplus carbide out of solution, cannot be foretold. All that is known at present is that four years after the hardening there is no sign of arrest in the progress of decay.

By temporarily heating the steel so as to allow a certain proportion of carbide to pass quickly out of solution, it is easy to forestall the natural decay of years, but this treatment only diminishes the rate of decay to some lower value to which in the natural course of events it would have fallen after a certain number of years. It does not appear that anything can be done to put a stop to the decay of hardened steel.

The discovery of a potency-giving molecule which would not suffer decomposition at temperatures attained during the manufacture of magnet steel would be advantageous, but

* For Parts I and II (first paper) see Electrical Review, May 2nd, 1920.

perhaps the greatest improvement it is possible to imagine, in connection with the manufacture of permanent magnets, would be to dispense with the hazardous process of hardening. What is needed is a potency-giving molecule which will dissolve so much more freely in alpha iron than any of the carbides at present in use, that the necessary potency will be given by a solution which is in equilibrium at ordinary temperatures. No carbide molecule now in use dissolves in alpha iron in sufficient quantity, but is it impossible to find one that will? Then again, carbon appears to be the only element which is capable of forming a potency-giving molecule, but is there any ground for supposing that it is necessarily the only element that will serve the purpose? No one knows what can be done, because no one has tried. The advantage of doing away with hardening will have one drawback. It may be confidently predicted that iron containing in solution the desired quantity of the hypothetical substance will be too hard to machine in any way but grinding; for it can hardly be doubted that potency and hardness both arise from the molecular pattern of solution.

In a more speculative field for discovery there is the possibility that the powerful magnetomotive forces latent in the atoms of the so-called non-magnetic elements may be made available for use in the same way that the magnetism of iron is now used in permanent magnets. Iron itself has long been calling attention, in vain, to the fact that an element can exist in either of two forms, magnetic and non-magnetic, the change from one to the other involving a fundamental reconstruction of the molecule if not the atom. The discovery of the electron and the electrical constitution of matter has opened our eyes, and it is now generally recognised that the atom is not the unchangeable entity it was long supposed to be. If iron can be reconstructed, why not other elements? Iron can exist at room temperature in either the magnetic or the non-magnetic form; and, again, why not other elements? The 26 planetary electrons in the atom of iron, running round their orbits, provide the magnetomotive force used in the permanent magnet of steel. If only it were possible to induce the 50 planetary electrons in the atom of tin, for example, or, better still, the 82 in the atom of lead, to behave in the same way as the electrons of the iron atom, we should have a magnetic mechanism of two or three times the magnetomotive force of iron, and where the permanent magnet based on the iron atom maintains a working flux density of 7,000, the magnet of tin would give 13,500, and with the reconstructed atom of lead as the basis of the magnet, a working flux density of 22,000 would be attained.

We have in the meantime to make the best of the permanent magnet as we know it. An attempt has been made in the present paper to look inside the steel and follow the progress of the molecules as they arrange themselves in the pattern of solution that gives a permanent magnet its power. After much discussion following on a lengthy experimental investigation, and the discovery of more than one troublesome metallurgical fact, we have at last managed to complete the making of what is called a permanent magnet. Beginning with the molecule of iron with its electrons travelling round their planetary orbits, the magnetic machine has been put together molecule by molecule. To obtain the molecular pattern that gives potency it has been necessary to support the mechanism by introducing certain molecules containing carbon—molecules which when in solution appear to behave like props retaining the magnetic mechanism in the required form. Having accomplished this with success, we become aware of the awkward fact that the carbide molecules do not stay where we put them. One after another they drift away from the positions of solution, and how to stop them we do not know, but, after all, even permanence is relative, and perhaps it is enough that the magnet should be rather more permanent than the man. Anyone who needs greater permanence than that must be content with a magnet made of steel in the softened state. In that condition the steel is a solution in stable equilibrium, and the potency is therefore everlasting. But for a given amount of useful magnetic energy, the volume of the magnet would be more than three times that of the hardened steel magnet, and there would be the further drawback that a magnet of softened steel is very easily demagnetised by stray magnetic fields.

So matters stand to-day, but the field of metallurgical discovery is still largely unexplored, and hidden away somewhere the material for the permanent magnet of the future may be waiting to be unearthed. It is already possible to foresee its essential characteristics.

Discussion in London.

MR. LL. B. ATKINSON opened the discussion with high praise for the paper; in it theory and practice were woven in an extraordinary manner, being the result of many years of careful thought and costly experiment. He illustrated the way in which the author approached the problems he had encountered and emphasised the infinite pains he took to make sure there was no fault in the arguments he put forward. He found the author's theory of the alteration which took place when iron passed from the alpha to the beta state difficult to follow, and they were on safer ground when it was suggested that at that point the metal was inclined to change into another element.

MR. E. A. WATSON, speaking with regard to metallurgy and magnetism, said they should be proud of the fact that an electrical engineer had put forward the wealth of knowledge to be found in the paper. He could not agree that the carbide was in solution, although it was in a very similar state; it was hard to say when it was or was not, but there was true solution and something very like it, which were not the same. He regretted the author's dismissal of the subject of chrome steel in a short paragraph. It was significant that chrome steel was used so much in other countries, and in the Ford factory, where the value of every piece of metal was very carefully considered, chrome-steel magnets were used for the car flywheel generators; in the U.S.A. tungsten steel was hardly ever seen. Although the coercive force decayed rapidly immediately after hardening, the remanence increased in the first day after hardening and, therefore, the B.H. maximum was the same or even increased slightly. The author had also not done justice to cobalt steel, but he had definitely laid one bogey by disproving that beta iron was present in hardened iron.

SIR HENRY JACKSON pointed out their indebtedness to Sir R. Hadfield in connection with the research work carried out. Although methods of chemical analysis were subtle, they failed completely when it came to an attempt to determine the natures of materials; there, magnetic investigation had been of great value.

MR. J. A. KAISER, speaking from the metallurgical point of view, took exception to the author's statement that . . . "the microscope fails to see the things that matter." They need not resort to X-rays or the ultramicroscope, but rather the steel should be examined at a magnification of, say, from 8 to 10 diameters. The reason for spoiled steel was that the more expensive varieties could not be rolled without hovering for long periods in the dangerous temperature zone. Some of them did know how to recover it, however, but when suitable heat treatment was suggested electrical engineers were up in arms at once. His experience of cast magnets had not been the same as that of the author.

MR. A. BROOKS suggested, with regard to microscopical examination, that the study should be of the unhardened steel. The degree of spoiling could be estimated closely by means of the microscope. That free carbon came out could hardly be correct; the "white areas" were dissolved by heat treatment and did not reappear on cooling.

MR. S. EVERSHED, in his brief reply, emphasised the great complexity of the subject and said that they were all more or less "at sea."

The Electric Furnace in the Foundry.

Its Possibilities and Limitations.

In a paper read before the London Branch of the Institute of British Foundrymen on February 19th, Mr. H. Etchells said that apparently the electric furnace was not proving itself suitable as a substitute for the crucible. Whilst it was being used to an increasing extent in various places for producing steel castings and was being installed abroad where water power was available for generating electricity, it was falling into disuse in Sheffield, a state of affairs for which, however, bad trade might be partly responsible. During the war a large number of electric steel furnaces were installed in Sheffield, but it was reported in January of this year that experiments in making steel by the electric furnace appeared to have been quite a failure in Sheffield as not half a dozen of the 60 furnaces installed six or seven years ago were now operating; some had been dismantled and others were standing idle. Mr. Etchells expressed the view that if the electric furnace was to be considered bad, both good trade and bad trade had combined to kill it. It should be remembered that it needed the practical hand of Robert Mushet to complete the genius of Henry Bessemer, and in the same way it needed the expert practical direction of a trained electric-furnace operator to produce results from the electric furnace. When electric furnaces were installed in considerable numbers those men were few and far between, with the result that the electric furnace during its latter years had suffered for the shortcomings of many untrained, or poorly trained, operators.

In spite of what had happened in the past, however, it was beginning to be realised that the electric furnace must play a definite role in home industries, and it could not be dismissed off-hand by saying that it was only useful where hydro-electric power was cheap. On the other hand, the sweeping statement could not be made that the electric furnace was an ideal melting instrument for all and every purpose, and the paper aimed at indicating the limitations and possibilities of the electric furnace in iron, steel, and brass foundries.

The steel industry, said the author, had developed the electric furnace in this country and, as a steel maker, he considered it the ideal instrument for melting steel. Steel-making troubles practically all arose from the presence of oxide of iron and the entanglement of slag. In the basic-lined electric furnace the steel was covered by a slag which was actively deoxidising, largely owing to the action of carbon in reducing silicon from the slag and to the complete control obtainable over the casting temperature up to the limit set by the refractories of the furnace lining, say, 1,700 deg. C.

The regular alloying of metals, such as nickel, chromium, tungsten, vanadium, &c., could be carried out without any risk of loss by oxidation and a really fluid sound steel, singularly free from non-metallic inclusions and blow-holes, could be obtained. Were it not for the advantages of the electric furnace, such materials as rustless iron could not be produced at all and certainly not on a large scale. Electric steel had also set a new standard of attainment for steels like nickel, chromium, and chrome vanadium, which had higher maximum stress, elongation, and impact values than open-hearth steel. Basic electric steel had given a remarkably good account of itself in the steel foundry and, temper for temper, had always a higher yield stress, a higher maximum stress, and greater ductility than comparable converter or open-hearth steel. For steel foundry work the basic furnace consumed from 800 kWh per ton in a 3-ton furnace, to 1,000 kWh per ton in a ¼-ton furnace; power, however, was the big cost in melting steel electrically and any large development could not be hoped for in this country until the cost of power was reduced to figures comparable to those in any other country.

As regarded electrodes, when graphite or carbon electrodes were used, the consumption costs were very much the same, but graphite electrodes introduced economies in handling. If they had cheaper electric power they would be particularly well situated for making electrodes in this country, and thus cheap power would effect a twofold economy. The quality of electric steel castings was well established and it only needed the electricity supply authorities to do their part to enable the severe competition from Italy, France, and the United States to be met, because those countries were in a position to make electric steel at the same price at which open-hearth and converter steel was supplied in this country.

Many reports had come over during the last three years as to the progress of the electric furnace in iron founding in the United States, an important factor being the cost of fuel and refractories in America. In the Western States cheap hydro-electric power had been a salvation because no civilised community, however small, could get along without the iron foundry. It was remarkable what a difference in physical properties was effected by passing iron through the electric furnace; a grey iron of 12 tons original tensile strength would jump to 22 tons per sq. in. and the structure of the metal was particularly uniform. The author said he had made white iron low in sulphur and phosphorus by starting originally with steel scrap and that such synthetic iron had been used quite satisfactorily by steel makers as a substitute for Swedish white iron.

Whilst the electric furnace was particularly useful in foundries which had to comply with rigid specifications, in the iron industry the wider use of the electric furnace depended to a large extent upon reductions in the cost of power, because there were very few lines in iron casting which would stand an additional £2 per ton in melting charges for refining the metal after it had passed through the cupola; the prospects in the iron industry were therefore extremely limited.

Considerable interest was being shown in electric furnaces for melting brasses and non-ferrous alloys and it was estimated that there were about 540 such furnaces in use in the United States, of which 140 had been installed during the past two years.

A study of steel and iron foundry practice showed that the results of evolution in design indicated the necessity for a furnace of comparatively simple construction in which the arc was the source of heat and actually made contact with the charge; that type of furnace, however, had a very limited application in the non-ferrous industry, and the induction furnace therefore made a strong appeal on theoretical grounds, although it had certain limitations. For continuous working, such a furnace with yellow brass and similar low-melting-point alloys had a power consumption of from 200 to 250 kWh per ton of metal. Another furnace was the radiation resistance type in which the heat was thrown on to the roof and reflected down on to the metal in the bath. In this case very heavy lagging was required to prevent heat losses through the roof and walls, because the whole mass of the furnace must be heated up before it began to melt the metal; this type consumed about 350 kWh per ton of red brass.

It did not appear that the arc furnace with its low capital cost and simple mechanism would be able to render any service in the non-ferrous alloy industry until the idea of rotating the furnace to obtain heat distribution was conceived. Such furnaces were generally constructed to maintain a free-burning arc between the electrodes which entered through the ends of the furnace body and it was perhaps the most flexible of all the types used for non-ferrous work. It heated very quickly and could be emptied completely, thus enabling a change of alloy to be employed if required; a furnace of 2 cwt. capacity had a power consumption of about 250 kWh per ton for yellow brass and of about 350 kWh per ton for bronzes, the electrode consumption being about 6½ lb. per ton. No great claim, however, could be made for improvement in physical properties. Although the fuel costs were higher, the author suggested that there was a real scope for the wider adoption of electric melting in the non-ferrous metal industries owing to the ability to handle metal in greater bulk. There was still, however, the need for a small and economical melting unit for non-ferrous alloys which would enable the non-ferrous caster to deal with small bulk and varying demand.

The paper did not deal in any way with the details of design of electric furnaces, but kept more to the metallurgical side of the problem. The other main feature was a plea for a reduction in the cost of electricity. It was suggested during the discussion that unless power could be obtained at ½d. per kWh, the rapid development and use of electric furnaces could not be looked for. Cases near London were mentioned in which 2d. and 2½d. per kWh had been asked for power for furnace purposes, with the result that any idea of proceeding further in this direction was abandoned.

Parliamentary.

(By Our Special Parliamentary Reporter.)

London Electricity Supply Bills.—On March 17th, a Committee of the House of Commons, consisting of Sir Arthur Shirley Benn (chairman), Sir Leonard Brassey, Sir Geoffrey Butler, and Mr. W. M. Adamson, commenced the consideration of the London Electricity Supply Bills (No. 1) and (No. 2). These measures passed the House of Lords during last session, but were held up by the General Election. The proceedings before the Lords Committee were reported in our issues of May 30th (p. 899) and June 6th (p. 941), 1924.

The Committee first considered the No. 2 Bill which is promoted by the London Electricity Joint Committee, Ltd., consisting of 10 West End companies. Petitions against the Bill were presented by the Poplar Borough Council, and the Corporation of the City of London. The City of London Electric Lighting Co., Ltd., watched the proceedings on behalf of the promoters of the No. 1 Bill, and the London County Council petitioned against alterations in the Bill as it left the House of Lords.

The Hon. Evan Charteris, who appeared for the promoters with Mr. Wrottesley and Mr. W. S. Kennedy, occupied the greater part of the opening day in tracing the history of electricity supply in London and the legislation with regard thereto. He said that the Bill came before the Committee in very auspicious circumstances; 10 companies were united as to policy; the local authorities, as a whole, did not oppose the Bill; and the L.C.C. was so far in agreement with it as to oppose any alteration. The Bill provided for the immediate transfer of the companies' undertakings to a Joint Electricity Authority instead of their being acquired by the L.C.C. in 1931. The Authority would then lease the stations to the Joint Committee (the promoters of the Bill) until 1971, when they would revert without payment to the Joint Electricity Authority. The Bill contained provisions for the regulation of dividends and prices. The Bill and the Order of the Electricity Commissioners setting up the Joint Electricity Authority were interdependent. An annual rental equal to 6 per cent. of the depreciated capital value would be paid to the Joint Electricity Authority, and at the same time a sinking fund would be formed to enable the stations to be handed back to the Authority free. The Corporation of the City of London did not oppose the Bill when it was before the House of Lords, but it now objected to relinquishing its rights of purchase over a portion of the undertaking of the Charing Cross Electricity Supply Co. The Poplar Corporation held that the new company would compete with its undertaking in the supply of electricity to docks and railways. If the Port of London Authority, for instance, took a supply from the new company in Stepney it could use it for all its docks, including those in the Poplar area. Counsel said that he did not see why the P.L.A. should not be able to do this instead of taking separate supplies for each district. Mr. W. F. Fladgate, chairman of the London Electricity Joint Committee, Ltd., and of the Charing Cross Electricity Supply Co., Ltd., then gave evidence in support of the Bill.

The evidence in favour of the No. 2 Bill was continued on Wednesday, March 18th.

Mr. Walter Leaf, chairman of the St. James' and Pall Mall Electric Light Co., and of the Westminster Bank, said he believed the new company would be able to obtain its capital at a lower rate than the companies could if they proceeded individually. He thought that capital could be raised at 5 per cent.

Sir Lynden Macassey said that as the company was to be allowed a dividend of 7 per cent. on new capital, 2 per cent. would go to the shareholders of the company. He asked what justification there was for making the consumers find money for the sinking fund in order that the Joint Electricity Authority should acquire the undertaking free of charge in 1971. In the past the practice had been to raise the money required when the undertakings were taken over.

Mr. Leaf said that as the undertaking in the present case was to be handed over in 1971 without charge, the only way to do it was to accumulate a sinking fund out of revenue between 1922 and 1971.

The Hon. Evan Charteris, for the promoters, said that the

procedure under the Electric Lighting Act of 1888 had never yet been interpreted and here, for the first time, was a definite basis upon which the London electricity supply undertakings were to be acquired on behalf of the public.

Sir LYNDEN MACASSEY then referred to the provision in the agreement allowing the companies to capitalise reserves, and pointed out that from 1913 to 1923 the accumulated reserve funds of the ten companies had risen from £2,066,000 to £6,655,000.

Mr. LEAF said that the free reserves would be utilised as capital in the business. Although the reserves were large, the consumer had also been given benefits.

Sir LYNDEN MACASSEY then asked whether it was right to charge the consumer 7 per cent. on these enormously increased reserves arising out of the war. In re-examination, it was made clear that the free reserves would be the amount remaining after depreciating the capital value of the physical assets. Witness said it might be that there would be no money left after this was done, and, indeed, he understood that that would be the case with some companies. Mr. Leaf also said that if the undertakings were taken over by the London County Council in 1931, a sinking fund would have to be established to meet the purchase price.

The Hon. EVAN CHARTERIS said it should be made clear that the capital raised by the new company would not receive the 7 per cent. mentioned in the agreement; the 7 per cent. would be paid to the distributing companies.

Mr. TINDAL ATKINSON, for the City Corporation, said the assumption was that the distributing companies would find the capital and therefore in effect 7 per cent. would be paid on capital raised by the new company at, say, 5 per cent.

Mr. J. M. KENNEDY (Messrs. Kennedy and Donkin) said there were eight power stations involved in this scheme having a total capacity of 336,000 kW. The new company would carry out the part of the technical scheme agreed upon previously with the engineers representing the companies, local authorities and the London County Council. The first work would be further to interconnect the various power stations and the installation of transforming plant in power stations which would not be extended for generating plant. Following on that there would be the erection of a new capital station, the first section of which should be in operation by 1928. If this Bill did not pass it would be necessary to extend all the existing stations. The interconnecting mains on the North of the Thames, together with the necessary switchgear and transformers, would cost £300,000. On the South of the Thames, the expenditure for similar purposes would be £150,000. The installation of transformers in generating stations to be closed down as such would cost £100,000. Extensions at the Grove Road power station would cost £205,000; and extensions at Willesden or Bow would cost £250,000. These works thus involved a total expenditure of over £1,000,000.

Under the new scheme, generating the same amount of energy, the cost would be reduced by 40 per cent. in 1927, and a year or two after that, the cost would have fallen certainly to below 50 per cent. of the present cost, to something like 0.27d. per kWh, leading to lower prices to the consumer. If the companies were left to go on as at present, the reduction in generating cost could not be more than 15 per cent.

Cross-examined by Mr. TINDAL ATKINSON, for the City Corporation, witness said that if the scheme did not go through, there would be no incentive for the companies to make great endeavours to improve the costs of production between now and 1931, assuming that in that year the London County Council would acquire all the London companies.

Mr. G. W. PARTRIDGE, one of the joint engineers to the promoters, and chief engineer and managing director of the London Electric Supply Corporation, also gave evidence in support of the scheme, as one of the engineers responsible for the technical scheme placed before the Electricity Commissioners. Cross-examined by Sir LYNDEN MACASSEY, witness agreed that the satisfactory working of the scheme under the Bill did not necessarily depend upon the Order of the Electricity Commissioners being put into force.

Sir WILLIAM PLENDER, who advised the London County Council in connection with the financial provisions of the agreement with the L.C.C., was then called, and he explained the method upon which the standard dividend and standard price were to be operated. He expressed the emphatic view that the sliding scale was fair both to the consumer and shareholders.

On March 19th Sir William Plender was cross-examined by Sir Lynden Macassey, K.C., on behalf of the City of London Corporation. Witness would not agree that the abolition of the downward movement in the sliding scale of gas companies—the principle adopted in this Bill—tended to withdraw the incentive to the companies to work as progressively as otherwise. The reason for the present action of Parliament in removing the downward slide was to protect the companies against what happened during the war, *viz.*, the reduction of dividends in some cases to the vanishing point.

Sir LYNDEN MACASSEY then said that the dividends had been increasing during recent years. Under the agreement the companies would be guaranteed the high dividends paid in 1922 until 1931. As an instance, he mentioned that the Charing Cross Co., which paid 5 per cent. uniformly until the war, paid 14 per cent. in 1922, with a bonus of 2 per cent., and it was this larger dividend which would be perpetuated.

Sir WILLIAM PLENDER said that there were some companies whose dividends had fallen. The London Electric Supply Corporation up to 1903 had paid no dividend at all, and although in 1922 the dividend was 10 per cent., the average during the whole of the company's existence was only 2 per cent. This was surely an instance of a company being fairly treated.

Sir LYNDEN MACASSEY said that while gas companies were able to secure the abolition of the downward slide on account of the difficulty in securing new capital under the old sliding scale, the electricity companies were experiencing no such difficulty, and in some cases had been able to issue new capital on extremely favourable terms.

Counsel then dealt with the operation of the sliding scale and standard prices for the different consumers, and suggested that it was possible that the lighting consumer who now paid the highest prices might get no benefit.

Sir WILLIAM PLENDER said that the Electricity Commissioners would see that all classes of consumer were treated fairly.

Replying to questions as to the likely amount of the free reserves after depreciation of the assets of the 10 companies, Sir William said he hesitated to give any figure at present, but, as a very approximate amount, it might be about £1,000,000 plus the premium on the capital issued, which premium amounted to something over £420,000.

Sir LYNDEN MACASSEY asked Sir William's view of the position if the terms of purchase in 1971 were under the Electric Lighting Act of 1888, as opposed to the terms under the agreement in the present Bill.

Sir WILLIAM said that the shareholders would derive greater advantage under the Electric Lighting Act "then value" terms than under the Bill. What would be the position if the sale took place in 1971 under the Electric Lighting Act terms was quite unknown.

Counsel said that Parliament must be shown how the terms of purchase in the two cases compared, if it were to be asked to alter the terms of purchase under the Electric Lighting Act.

Sir WILLIAM replied that, personally, he would prefer to sell in 1931, from the companies' point of view. He would not agree that the companies were doing better under the agreement.

The Hon. EVAN CHARTERIS, K.C., in the course of his re-examination of Sir William Plender, pointed out that whereas, in the case of land, the "then value" would have to be paid in 1931 if purchase took place under the Act of 1888, under the Bill, the land would be purchased at the price originally paid by the companies, a very much lower figure.

Mr. WILLIAM CASH, chartered accountant, was the next witness. Dealing with the cost of purchase in 1931 under the Electric Lighting Act of 1888 as compared with the terms in the Bill, he said that the companies would undoubtedly be much better off by purchase in 1931 under the terms of the Act of 1888. For instance, assuming that there was no serious drop in prices from those to-day, the buildings would have to be purchased at a higher figure than they cost. The same applied to cables and other parts of the undertakings. In addition, there was a point which had not been sufficiently emphasised, *viz.*, that after 1931—up to which time the companies had certain rights which must be recognised—a new standard price would be calculated, taking into account the then costs of production, so that the advantages of the economies in working would be handed on to the consumer. Another advantage to the consumer was the stabilisation of the 1922 dividend of the companies as the standard until 1931, it being remembered that the dividends since 1922 had been going up. The London County Council considered that the companies had made concessions, and, indeed, on certain points, the Council had got rather more than it had anticipated.

During the course of a long cross-examination by Sir Lynden Macassey, on behalf of the City of London Corporation, dealing with the past history of the sliding scale as applied to the gas industry, Sir LYNDEN MACASSEY said the fact he wanted to bring out was that the Board of Trade had definitely given evidence that it was not in favour of the slide only operating in one direction.

Mr. CASH said that the effect of competition and the general desire of the directors to do their best for the consumers was just as great as if the slide operated both ways.

In the course of further cross-examination, Sir LYNDEN MACASSEY contended that under the sub-division of the various classes of consumer in the agreement, for the purpose of arriving at the standard price, the lighting consumers who were charged the most would get little relief, and that all the benefit might go to the other classes.

Mr. CASH said that every endeavour had been made to safeguard the interests of all consumers, and the final decision was to be left to the Electricity Commissioners.

The Committee then adjourned until March 24th.

Horley District Gas Company (Electricity Supply) Bill.—A House of Lords Committee, presided over by the Earl of Clarendon, commenced consideration of this Bill on March 18th. Its main object is to empower the Horley District Gas Co. to supply electricity, and to run the gas and electricity undertakings jointly. The Horley and District Electricity Supply Co., Ltd., which was registered in 1924, opposed. This company has applied for a Special Order authorising it to supply electricity within an area, the main part of which is in the area of supply of the gas company, and that Order has been passed to the Ministry of Transport for confirmation.

Sir HARRY COURTHOPE-MUNRO, K.C. (who appeared with Mr. Jaques Abady for the promoters), said it had been found

not to be inconsistent to put the supply of gas and electricity into the hands of one company, and he would call evidence to show that where that had been done there had been an increase in the supply of electricity side by side with an increase in the supply of gas. Parliament had authorised gas companies to supply electricity in 21 cases. The Gas Co. had decided, in 1922, to seek powers to supply electricity. A statutory gas company such as this could only obtain those powers by promoting a Bill in Parliament, but any body other than a statutory company could take advantage of the provisions of the Electric Lighting Act of 1888, as amended by the Electricity (Supply) Act, 1919. In 1924, Mr. R. G. Clarry (M.P. for Newport) had introduced a Bill to enable statutory gas companies to apply to the Electricity Commissioners for Orders in the same way as other bodies. That Bill was unopposed on second reading, and would no doubt have been passed, but for last year's General Election. It had been reintroduced this year, and had passed its second reading. The Gas Co. had decided to await the passage of Mr. Clarry's Bill, and, as it appeared that it would be passed, the Gas Co. gave formal notice to the Electricity Commissioners on June 7th, 1924, that it had decided to apply for powers to supply electricity. On July 15th, in view of the uncertainty of the passage of Mr. Clarry's Bill, the Company resolved to promote a Bill, and on October 18th, notice was published of the intention to apply for the Bill. In October, however, the Horley and District Electricity Supply Co., Ltd., was registered, and applied to the Electricity Commissioners for power to supply. Although the Gas Co. had given notice to the Commissioners of its intention, no inquiry was held, and the Commissioners granted the Electricity Co. an Order on January 20th, 1925, which had been sent to the Minister of Transport for confirmation. A memorial had been presented by the Gas Co. asking for an inquiry.

Still more remarkable was a report by the Minister of Transport in connection with the present Bill, which, he ventured to think, was in the nature of dictating to the Committee the course it should adopt. The report stated that the Minister had received the Electricity Co.'s Order from the Commissioners for confirmation, and he understood that the application for the Order was supported by the Reigate Rural District Council, in whose district the parishes to be supplied were situated. The real position, said counsel, was that the Rural District Council merely was not taking sides in the matter. Also, not having heard the Gas Co., the Electricity Commissioners had seen no grounds for refusing the Special Order. As to the statement in the report that it was contrary to general practice, and would not be conducive to the public interest, to invest two separate bodies with power to supply electricity in the same area, counsel asked whether that was not a suggestion to the Committee to throw out this Bill. He asked the Committee to consider the Bill on its merits, and to disregard the extraordinary position brought about by the legislature. The Bill asked for additional capital powers of £30,000 with borrowing powers to half that amount, making £45,000.

Mr. Arthur Broadberry (director of the Tottenham Light, Heat and Power Co., and a Past President of the Institution of Gas Engineers), in evidence, said he thought that both public and private interests would be best served if the supply of electricity, where possible, were in the same hands as the gas supply. He referred to the successful manner in which the Tottenham Light, Heat and Power Co. had developed the Wood Green area in respect of electricity supply, in conjunction with gas supply. The company had realised that there was a growing demand for electricity, and had felt that it was a demand that ought to be supplied, and that the company, as a public supplier of light, heat and power in the form of gas, could supply electricity with greater advantage to the community than could a separate company. At Wood Green the Company had a showroom displaying both electrical and gas appliances. There were economies arising from the supply of electricity by gas companies. Management was less costly, as staffs did not need to be duplicated. It was also realised that the heat arising from gas manufacture, which had been wasted for years, should be properly utilised, and his company was utilising waste heat for generating electricity for its own purposes at the gas works.

Another advantage resulting from the exercise of electricity powers by a gas company was in connection with the raising of capital. In America, where the practice was for gas and electricity supply to be in the hands of the same companies, there was a very great growth in electricity consumption.

The committee adjourned until March 20th, when Mr. Broadberry was cross-examined by Mr. Tyldesley Jones, K.C., and in reply to questions agreed that the greater part of the heat commonly termed "waste heat" was used in up-to-date gasworks. So far the Horley Co. had not used it, but Mr. Broadberry said that this would not make much material difference in the price of gas.

Counsel suggested that the figures given for the Wood Green district did not show that the system was advantageous, but Mr. Broadberry said that they did. Counsel said that the statement that, in a general sense, gas represented heat and electricity represented light, showed the attitude of a gas company towards electricity supply. It was only by developing a power load in the daytime that the electricity supply companies could supply lighting cheaply in the evening. The witness said that if the electrical companies got the cooking load they would be ruined. Electricity could not compete with gas for cooking, although it was suitable for small power applications. Counsel secured witness's agreement to the statement that the consumption of electricity in Wood Green was 20 kWh per head, as compared with an average of 50 kWh per head where there were competitive gas and electricity undertakings.

Mr. G. M. Gill (late chief engineer to the South Metropolitan Gas Co.) said that great economies were obtainable by the supplying of electricity from an existing gasworks, particularly as regarded the questions of site and staff. In small works such as that at Horley the waste heat could not be used inside, but it would be available for the generation of electricity. Witness agreed that competition had forced the South Metropolitan Gas Co. to keep its service at an efficient pitch, but said that competition was of no use in a small town. Counsel suggested that had it not been for the advent of electricity the gas industry would not have been so efficient to-day, but witness would not agree. In reply to further questions, he said that 900 lb. of steam per hour could be generated from waste heat when 18 tons of coal were carbonised per day.

Mr. A. Hugh Seabrook said that the experience of the Gas Light & Coke Co. had proved that much could be done with gasworks' surplus heat (a term which he preferred to "waste heat"). The biggest works of this company was putting down a 2,000-kW generating plant, the whole of the necessary steam being supplied by surplus-heat boilers. It was estimated that the whole of the surplus heat would produce 20 or 30 million kWh a year, with a consequent saving of fuel, which could be used for other purposes. At Horley it was proposed to use a 240-V single-phase system. The company expected a maximum demand of 50 kW, and would supply at the rate of 10d. per kWh for lighting and 3d. for power (an estimated average of 8.6d. per kWh). A quarter of the output would be generated by means of other fuel. The net profit for the year was estimated at £532. In the second year, with an increased demand of 75 kW, one-third of the output would be obtained from other fuel, and a net profit of £968 was expected. If the consumption of gas increased (as it often did in such cases) more than two-thirds of the output would be generated by means of surplus heat. In the second year the capital would have reached £6,270 for plant and £10,000 for mains.

Mr. Tyldesley Jones suggested that the idea of combining gas and electricity production had been "damned" by competent engineers, and witness assented. He admitted that such a combination involved a danger of "restraint of trade." Counsel said that no allowance had been made for the effect of the supply of electricity upon the cost of producing gas, and witness replied that the gas company would not really be any worse off because the heat was at present totally wasted. He also said that no allowance could be made in a station of the suggested size for stand-by plant.

Major D. Napier-Whittingham (acting manager of the Sussex Electricity Supply Co., Ltd.) said that his company would take a bulk supply of electricity from the Horley Gas Co. to avoid the installation of further plant. Cross-examined by Mr. Tyldesley Jones, he said that his company would prefer to do this rather than take a supply from a newly-established electricity company. He returned no answer when counsel suggested that a breakdown would cause a cessation of the supply.

The final sitting of the Committee was held on March 24th, when after hearing further evidence, it was decided to allow the Bill to proceed.

Smoke Abatement.—On March 19th, Mr. N. Chamberlain, Minister of Health, informed Mr. R. Young and Captain Reid that he hoped to introduce a Smoke Abatement Bill next session.

Rural Telephones.—On March 19th, Sir W. Mitchell-Thomson informed Lt.-Col. Troyte that new rural telephone exchanges were opened as soon as a minimum of eight subscribers was forthcoming. During the last three years 668 rural exchanges had been opened under that system and 78 more had been authorised. Special facilities were also offered to farmers and others for the co-operative use of party lines in rural districts. The loss on those services had to be borne by the general body of subscribers, and he regretted that he could not at present see his way to propose further reductions in the charges for service in rural areas.

"Beam" Stations. — On March 16th, Lord Wolmer, Assistant Postmaster-General, informed Sir H. Brittain that a site near Bodmin for the sending station for the "beam" service with Canada had been placed at the disposal of Marconi's Co., and it was anticipated that a site near Bridgwater, for the corresponding receiving station, would shortly be available. The same sites would be used for the stations for communication with South Africa, and an order for the stations would be given as soon as official information was received concerning the erection of corresponding stations in South Africa.

Licence Fees for Receiving Sets.—On March 17th, Sir W. Mitchell-Thomson, Postmaster-General, informed Mr. Day that he did not consider that differentiation could be made between crystal and valve sets in fixing the fee payable for a broadcast receiving licence. If it should be found possible at some future time to make a reduction in the present licence fee, it would apply to both types of sets.

On March 19th, Lord Wolmer informed Captain Fraser that the possibility of reducing the broadcast receiving licence fee, as the number of licence holders increased, would not be lost sight of.

Radio Licences. — On March 17th, Sir WM. MITCHELL-THOMSON informed Lt.-Commdr. Kenworthy that the number of experimental transmitting licences in force at the end of February was about 2,200, and the number of receiving licences was about 1,311,000.

On the same day Sir W. MITCHELL-THOMSON informed Sir J. Nall that he was advised that the practice of charging fees for experimental wireless licences was not contrary to the provisions of the Wireless Telegraphy Act, 1904. The scale of fees was reduced in January.

Post Office Tube Railway.—On March 17th, Mr. BROAD asked what was the present position of the work in connection with the Post Office tube railway and when it might be expected to be in full working order.

Sir WM. MITCHELL-THOMSON said that the permanent way was practically completed, and contracts had been placed for the electrical equipment and rolling stock. It was anticipated that the railway would be ready for operation in the latter part of 1926. The sum provided under the Post Office (London) Railway Act, 1913, was £1,100,000 The sum expended to date was £1,296,450, and it was estimated that about £310,000 would be required to complete the undertaking.

Proposed New Tube Railway.—On March 17th, Colonel W. ASHLEY, Minister of Transport, in reply to Mr. Scurr, said he was not aware that any of the Underground Railway Companies proposed to seek statutory powers for the construction of a new tube railway from Aldgate to Barking. In the event, however, of such powers being obtained, it would be open to the promoters to ask the Trade Facilities Act Advisory Committee to recommend that assistance by way of guarantee should be given. He had asked the London Traffic Advisory Committee to report on the passenger transport facilities between the City and Ilford, Romford, and Barking.

The Apprenticeship System. — On March 18th, Sir A. STEEL-MAITLAND, Minister of Labour, informed Mr. Groves that he had arranged for an inquiry to be held in the near future with regard to the present state of apprenticeship in the various trades.

Private Bills.—The Statutory Gas Companies (Electricity Supply Powers) Bill has been read a second time in the House of Commons.

The British Empire Exhibition, 1925.

Improvements in the Electrical Illumination.

EXPERIENCE gained during the first season of the great Exhibition at Wembley has led the authorities to provide for the lighting of the grounds and the exterior of the buildings on a scale much more lavish than that originally adopted; brilliancy will be the keynote of the scheme, and many spectacular features are to be introduced. For this purpose the consulting engineers, Messrs. Sparks & Partners, enlisted the assistance of the Electric Lamp Manufacturers' Association, and a scheme of illumination was devised by the Lighting Service Bureau, which met with the approval of the Board of Directors. To remodel the lighting of the whole of the grounds would have been too costly, and therefore the new effects will be introduced in certain sections where visitors are most likely to congregate in the evenings.

Many of the principal buildings and entrances will be outlined with electric lamps in carefully selected colours, and some of the garden beds will be similarly treated. In the north gardens and at the south-west entrance will be installed two illuminated columns of neon tubes, some 40 ft. high; these monuments, having the appearance of columns of fire, will throw a softly diffused glow over the large areas which they are intended to illuminate, and will give a warm welcome to the visitors as they enter the gates.

Special attention is being devoted to the lighting of Kingsway, between the two great palaces. In this section 60 tall standards are being erected, each of which will be fitted with 20 yellow-sprayed 100-W gasfilled lamps suspended from a corona fitted at the top of the post, which will also carry one of the illuminated globes which were a feature of the lighting last year. The light from these lamps will bathe the grounds and building fronts in a glow of golden light.

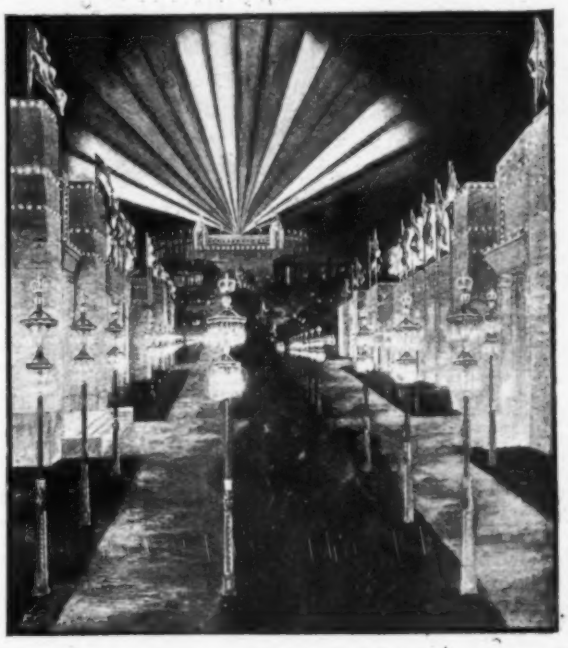
In order to provide contrast, and to throw into relief the stately colonnades of the Palaces of Engineering and Industry, two floodlight projectors of a special type will be concealed behind each column, one at the top and the other at the bottom. The lower projectors will be fitted with light blue colour screens and 1,000-W gasfilled lamps, throwing the light upwards on to the wall. The upper projectors, containing 500-W lamps, will be fitted with magenta or rose pink colour screens, and so arranged that a flood of tinted light is projected downwards. The lamps in the upper unit will be connected to a motor-driven automatic dimmer, thus providing constantly changing colours on the background.

On the roofs of the buildings in Kingsway pipes are being installed, from which columns of steam will be emitted behind each flagstaff. Each steam jet will be illuminated by means of a 500-W floodlight projector fitted with a colour screen. This feature is particularly striking, giving the effect of coloured flames dancing in the breeze. In addition, the buildings will be outlined with 20-W yellow-sprayed lamps at 18-in. centres, the panels on the buildings being treated with green lamps and the bases of the flag poles with red.

Proceeding through Kingsway, and passing over the bridges, the attention of the visitor will be arrested by the spectacle of illuminated swans, ducks, Noah's arks, water lilies, and grotesque fish floating on the lake by the water's edge. Standing on the rocks near Digger's Bridge a family of illuminated penguins are being installed, and on the lawns, on the southern side of the lake, illuminated frogs, snails, tortoises, rabbits, and hares will be located in suitable positions.

Overhead, some of the trees will be found to be alive with flocks of brilliantly lighted and gaily coloured parrots and owls. One spreading oak will be the centre of a miniature "Garden of Eden," and will have suspended from its branches luminous apples of enormous size. Entwined around the trunk will be seen a forbidding serpent studded with green lamps. The trees on the tea or dancing island will be fitted with large oranges and lemons containing 60-W lamps. This, in addition to adding a note of colour, will provide a soft illumination over the area below. The special devices mentioned above are being manufactured in waterproof silk stretched on wire frames and hand-painted in oils, and it is remarkable what lifelike effects can be obtained in this manner.

The rockery gardens and rocks will sparkle with the light of a thousand coloured tulip lamps fitted in the recesses



The Lighting of Kingsway and the Stadium.

formed by the stonework, and many of the garden beds in different parts of the grounds will be outlined with gaily coloured lamps.

Standing high in the background, and visible from all directions, is the imposing Stadium building. The frontage will be flooded with a rich amber light from concealed projectors, and the colonnades will be emphasised and thrown into relief by the use of concealed lighting of a contrasting colour. In addition, the principal features will be outlined with 20-W lamps at 18-in. centres. On the roof, visible for miles in all directions, will be a mammoth fan of coloured searchlight beams, recalling the magnificence of the *aurora borealis*. For this purpose a battery of twelve 60-centimetre searchlights, fitted with colour screens, is being installed; these units, which have been kindly lent by the military authorities, are to be operated by the 27th A.A. Battalion R.E. (T.A.) London Electrical Engineers, and displays in the nature of a searchlight tattoo will be given each evening.

Viewed from the Bank at the north end of Kingsway through the glow of golden lights, the ever-changing colours of the colonnades, the steam jets wavering in coloured beams, which, in the background, the grandeur of the Stadium surmounted by the gorgeous coloured fan, will form a spectacle which should have an irresistible appeal to the vast population of London whom it is hoped to attract. We give an illustration of the view, which, though robbed of its brilliancy of light and colour by the limitations of the printing press, will at least convey some idea of the nature of the scheme.

Legal.

Re Fred. Price & Co. (1920), Ltd.

In the Companies' Winding Up Court, on March 17th, Mr. Justice Romer had before him the petition of Sir Edward Nicholl and Sir William Henry Diamond, for an order for the compulsory liquidation of the above company, electrical and general mechanical engineers, of Cardiff.

Mr. W. P. Spens, K.C., for the petitioners, read affidavits to the effect that the company had been carried on at a loss almost since the date on which it was incorporated to take over the business of Mr. Fred Price; that the petitioners were induced to invest money in and become directors of the company by representations that it had made large profits; that they resigned their directorships as they had no desire to be connected with a company that was insolvent; and that there was a complete deadlock in the company's affairs.

For the company Mr. H. B. Vaisey, K.C., read affidavits denying all these allegations.

His Lordship, in dismissing the petition with costs, said the majority of the shareholders wanted the company to go on, hoping that things would improve, and this was a matter essentially for them.

Edgar Allen & Co., Ltd., v. Stobie.

In the King's Bench Division, on March 16th, this case against Victor Stobie (trading as the Stobie Steel Company or the Stobie Metallurgical Construction Company, at Dunston-on-Tyne) came before Mr. Justice Greer. It related to a sale by the defendant to the plaintiffs of furnaces for the production of electric steel, and the question was raised whether the contract contained a guarantee that the furnaces should produce 200 tons of steel at a consumption of 200 kWh per hour.

The defendant's case was that the purpose of the furnaces was not communicated to him. He said that nothing precise on the subject was said but only by way of estimate and opinion and that this did not form part of the contract. Defendant was the patentee of a method of linking up two electrical furnaces for the duplex process.

Mr. Justice Greer found against the plaintiffs, holding that there was no such guarantee incorporated in the contract as alleged by the plaintiffs. He accordingly gave judgment for the defendant.

Leave to appeal was asked for and granted.

Malin v. Alfred Bond (London), Ltd.

In the Mayor's and City of London Court, on March 13th, before Judge Shewell Cooper, Messrs. Malin, cabinet manufacturers, Hackney Road, sued Alfred Bond (London), Ltd., Creechurch Lane, E.C., general dealers, for £26 11s. for work done and materials supplied. Mr. Howard, counsel for the plaintiffs, said that the plaintiffs received an order in October last for 200 wooden candlesticks, of various sizes, which were to be made to take electric light bulbs. Upon the order given to the plaintiffs was a statement that delivery was to be made in seven days. Plaintiffs had delivered practically all the goods ordered, and the question at issue was whether the defendants were entitled to reject the goods. The defence, which was accompanied by a counter-claim for £13 7s. 6d. loss of profits, was that the goods were not up to sample, and that the plaintiffs did not deliver within the contract time.

Judge Shewell Cooper, after inspecting the candlesticks, said that he came to the conclusion that the defendants had a right to reject the goods on the ground that they were not up to sample. It had been admitted by the defendants that one of their customers had consented to retain goods which had been re-sold by the defendants after delivery by the plaintiffs, and therefore, as they admitted, the defendants were liable for the sum of £7 5s. 6d. On other small accounts between the plaintiffs and defendants, his Lordship expressed the view that £2 9s. 6d. was due and therefore plaintiffs succeeded to the extent of £9 15s. Judgment was therefore given for the plaintiffs on the claim for £9 15s. and costs, and for the defendants on their counterclaim for 10 guineas, with costs.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1923.

21,004. "Method of and arrangement for the production of continuous electrical oscillations." W. Ritscher. August 18th, 1922. (202,653.)

21,373. "Advertising devices, publicity telegraphs, and the like." H. K. Harris. August 23rd, 1923. (Cognate applications 25,812/23, 30,800/23, and 8,936/24.) (229,713.)

26,518. "Receiving apparatus for use in wireless telephony and telegraphy." J. Rogers. July 24th, 1924. (229,729.)

26,828. "High-frequency transmission." Western Electric Co., Ltd. (Western Electric Co., Inc.). October 26th, 1923. (229,732.)

29,885. "Submarine cables." W. S. Smith. November 27th, 1923. (229,752.)

29,916. "Globe fittings for electric lamps." W. McGeoch. November 28th, 1923. (229,753.)

29,957. "Systems of electric control." English Electric Co., Ltd., and F. Morris. November 28th, 1923. (229,754.)

29,969. "Switching keys for telephone systems." Siemens Bros. & Co., Ltd., W. E. Goodwin and E. R. Garrod. November 28th, 1923. (229,756.)

30,089. "Receiving and transmitting telephones, including loud speakers." H. J. Round. November 29th, 1923. (229,759.)

30,125. "Semi-automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd., and J. E. Ostline. November 29th, 1923. (229,761.)

30,225. "Automatic or semi-automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd., and W. O. Passmore. November 30th, 1923. (229,765.)

30,226. "Telegraphic and telephonic cables." W. S. Smith. November 30th, 1923. (229,766.)

30,383. "Automatic or semi-automatic telephone systems and apparatus for use therewith." Automatic Telephone Manufacturing Co., Ltd., and J. E. Ostline. December 3rd, 1923. (229,779.)

30,400. "Method of manufacturing magnet-cores." Felten & Guilleaume Carlswerk Akt. Ges. December 5th, 1922. (208,147.)

30,523. "Regulators for electrical discharges." British Thomson-Houston Co., Ltd. January 30th, 1923. (210,743.)

30,704. "Acoustic reproducing devices." Western Electric Co., Ltd. (Western Electric Co., Inc.). December 6th, 1923. (Addition to 210,906.) (229,786.)

30,780. "Electric multi-core cables." British Insulated & Helsby Cables, Ltd., and A. H. Selwyn. December 7th, 1923. (229,788.)

30,824. "Electric relays." T. W. Ross, C. Ryder, and Metropolitan-Vickers Electrical Co., Ltd. December 7th, 1923. (229,789.)

31,015. "Electrolytic apparatus." J. P. Scott. December 10th, 1923. (229,792.)

31,131. "Electrical synchronising apparatus." T. W. Ross, A. P. Thompson, and Metropolitan-Vickers Electrical Co., Ltd. December 11th, 1923. (229,793.)

31,140. "Reception of wireless and other signals." J. Hettinger and C. A. Vanderwell. December 11th, 1923. (Addition to 130,308.) (229,794.)

32,574. "Electric induction heating apparatus, particularly for smelting purposes." Electrical Improvements, Ltd., and L. C. Grant. December 31st, 1923. (229,809.)

1924.

123. "Electric terminal tags and connectors." A. E. Chapman. January 2nd, 1924. (229,811.)

944. "Directional wireless systems, particularly applicable to marine navigation." J. D. Roots. January 12th, 1924. (229,820.)

1,017. "Covers or casings for joints in electric cables." Callender's Cable & Construction Co., Ltd., and J. F. Watson. January 14th, 1924. (229,821.)

1,154. "Magnet for telephone receivers." G. Turnock. January 16th, 1924. (Cognate application 8,942/24.) (229,823.)

1,390. "Electric alarm systems for the protection of safes or the like." W. Becauori. January 17th, 1924. (229,826.)

1,563. "Electric lighting and like systems having a constant-voltage and a variable-voltage source of supply current." T. Ferguson, J. R. Johnstone, and Metropolitan-Vickers Electrical Co., Ltd. January 19th, 1924. (229,827.)

1,745. "Voltage-limiting devices for telephone circuits." Western Electric Co., Ltd. (Western Electric Co., Inc.). January 22nd, 1924. (229,828.)

1,828. "Distribution boxes or cases for electrical fuse units." E. Wilson and L. B. Allen. January 23rd, 1924. (229,830.)

1,833. "Electrically operated braking device for use in connection with weighing apparatus." Pooley & Son, Ltd., and H. and J. Dobson. January 23rd, 1924. (229,831.)

1,973. "Oil-immersed electric transformers." A. W. G. Tuchar and Ferranti, Ltd. January 24th, 1924. (229,833.)

2,023. "Telephone and like head instruments." C. Terry. January 25th, 1924. (229,836.)

3,343. "Lead-covering of electric cables and the like by extrusion." W. T. Henley's Telegraph Works Co., Ltd., and E. E. Judge. February 8th, 1924. (229,846.)

3,542. "Thermionic valve installations." R. Depriester. February 10th, 1923. (211,160.)

3,655. "Method of and apparatus for electromagnetic testing of metals." American Chain Co., Inc. July 24th, 1923. (219,640.)

4,551. "Crystal detectors for wireless receiving sets." H. Hibbert. February 22nd, 1924. (229,856.)

5,216. "Burglar alarms." G. B. Carpenter. February 29th, 1924. (229,862.)

7,234. "Microphonic capsules for use in telephone transmitters." Western Electric Co., Ltd. (L. van Rutten). March 21st, 1924. (229,879.)

7,456. "Electric transformers for use with measuring instruments." K. Edgcumbe, E. I. Everett, and F. E. J. Ockenden. March 24th, 1924. (229,881.)

7,721. "Thermionic devices." Dubilier Condenser Co. (1921), Ltd. March 26th, 1923. (213,584.)

9,155. "Road vehicle electric lamps." Howes & Burley, Ltd., and A. J. Curnow. April 10th, 1924. (229,894.)

9,342. "Head-bands for telephone receivers." J. Macdougall. April 12th, 1924. (Cognate application 10,666/24.) (229,896.)

9,807. "Electric drives for gramophones and the like." British Thomson-Houston Co., Ltd. (General Electric Co.). April 17th, 1924. (229,898.)

10,725. "Concrete or like moulded boxes for protecting electric cable joints." Tarmac, Ltd., and E. L. Cotterell. May 1st, 1924. (229,904.)

13,419. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). May 31st, 1924. (229,911.)

14,333. "Measurement of frequency of electric currents." E. Maller. June 13th, 1924. (229,919.)

14,951. "Secret signalling systems." Western Electric Co., Ltd. June 30th, 1923. (218,282.)

14,960. "Wireless receiving apparatus." Marconi's Wireless Telegraph Co., Ltd. July 24th, 1923. (219,660.)

17,171. "Electric lamps." C. Matthey. July 19th, 1923. (219,324.)

17,903. "Electric switch-operating mechanisms." British Thomson-Houston Co., Ltd. August 1st, 1923. (219,978.)

18,141. "Electrical conductors and method of making same." A. E. White (Kerite Insulated Wire & Cable Co.). July 29th, 1924. (229,932.)

18,337. "Electric fires." C. R. Belling. July 31st, 1924. (229,933.)

18,451. "Conversion of electric currents." S. A. Kukel. September 27th, 1923. (Addition to 221,176.) (222,451.)

18,632. "Methods of and means for coding solenoid windings." Compagnie Internationale des Freins Automatiques Soc. Anon. August 8th, 1924. (230,310.)

18,973. "Radio-receiving systems." A. S. Cachemaille (Westinghouse Electric Manufacturing Co.). August 9th, 1924. (229,938.)

19,345. "Electric pocket lamps." E. Gegauf. August 15th, 1924. (229,942.)

19,572. "Electric protective systems." British Thomson-Houston Co., Ltd. (General Electric Co.). August 18th, 1924. (229,944.)

19,586. "Method of and apparatus for receving radio signals." Marconi's Wireless Telegraph Co., Ltd. August 17th, 1923. (220,660.)

19,840. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. December 23rd, 1922. (Divided application on 209,040.) (230,955.)

20,059. "Process of producing a protective and at the same time electrically insulating coating." O. Bauer and O. Vogel. December 29th, 1922. (226,776.)

20,606. "Dry batteries." Burgess Battery Co. September 1st, 1923. (221,230.)

20,707. "Multi-core electric cables." W. T. Henley's Telegraph Works Co., Ltd., and P. Dunsheath. September 2nd, 1924. (229,948.)

21,103. "Tramway rails." C. Andersen, L. Christiansen, L. Flodin, and A. Flodin. September 8th, 1924. (229,951.)

22,940. "Mercury arc devices." Metropolitan-Vickers Electrical Co., Ltd. September 28th, 1923. (222,509.)

23,403. "Electric condensers." Telegrafia Ceskoslovenska Totarna pro Telegrafy a Telefony Akciova Spolecnost and S. Sotek. October 4th, 1924. (229,964.)

30,709. "Dry batteries." Burgess Battery Co. September 1st, 1923. (Divided application on 221,230.) (226,568.)